Physical Activity Patterns of 10-11 year olds during the school week

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Student Declaration

This work is original and has not been submitted previously in support of a degree qualification or other course.

Signed .....

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Abstract

Physical Activity Patterns of 10-11 year olds during the school week

Physical inactivity among children has both immediate and long term health consequences. Recommended guidelines state that children should engage in at least 60 minutes of at least moderate physical activity each day to promote and maintain health. The main purpose of this study was to determine the proportion of 10-11 year old children who were engaging in sufficient physical activity to meet the recommended levels throughout the school week. This study also aimed to determine differences by day, to examine the contexts in which children were achieving their activity and to investigate gender differences. Fifty three 10-11 year olds (18 boys, 35 girls) completed activity diaries each day for one week during the school term. Activities were recorded for the whole of the waking day and intensity assigned to one of four levels, very light, light, moderate or vigorous. The contexts in which the activities took place were categorised as, school based clubs, school based free play, home based clubs or home based free play. Paired t tests, independent t tests, cross tabulation and Chi square tests were conducted to determine differences by day, by activity category, and by gender. The proportions meeting recommended levels varied from 64.2% on Sunday to 83.0% on Thursday. Lower proportions met recommended levels per weekend day, 70.8% than per school day, 78.5%. Significantly ($P < 0.05$) more time was spent in free play than organised activities. The proportion of total daily moderate to vigorous physical activity (MVPA) from free play was 74.2% on school days and 81.4% on weekends. Out of school activities were significantly ($P < 0.05$) greater than in school activities, accounting for 62.1% of total daily MVPA. The proportion of boys achieving recommended levels was greater than the proportion of girls on each day of the week, the differences between the genders being significant ($P < 0.05$) on Saturday and Sunday. Boys engaged in more free time activity than girls both on school days and weekend days, with in school free time and weekend day free time activity being significantly ($P < 0.05$) greater. Girls engaged in more organised activities than boys on school days and weekend days but not significantly ($P < 0.05$). On each day of the week a proportion of children did not meet recommended activity levels to benefit health. Activity levels differed by day, gender and context. Both boys and girls achieved more of their MVPA from free play than from organised activities both in and out of school. Initiatives which focus on improving the time and facilities available to children to enable them to participate in safe free play may be effective in increasing health enhancing physical activity.

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Glossary

Key Stage 2	Year 3 to Year 6 in primary school for children aged 7 to 11
National Curriculum	Nationwide curriculum for primary and secondary schools
Physical Activity	Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. (Caspersen, Powell & Christensen, 1985).
Programme of study	The programme of study sets out what pupils should be taught in each subject at each key stage
Standard Assessment Tests	Tests used to assess the attainment of children at the end of the key stage

List of Abbreviations

Abbreviation	Full Name
CVD	Cardiovascular Disease
DCSF	Department for Children Schools and Families
DCMS	Department for Culture, Media and Sport
DfES	Department for Education and Skills
DH	Department of Health
HOMA-IR	Homeostasis Model of Assessment of Insulin Resistance
KS2	Key Stage 2
METs	Metabolic Equivalents
MPA	Moderate Physical Activity
MVPA	Moderate to Vigorous Physical Activity
NC	National Curriculum
PA	Physical Activity
PE	Physical Education
NHS	National Health Service
PESSCL	National PE, School Sport and Club Links Strategy
PESSYP	PE and Sport Strategy for Young People
QCDA	Qualifications and Curriculum Development Agency
SATs	Standard Assessment Tests
VPA	Vigorous Physical Activity
YST	Youth Sport Trust

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Chapter 1

Introduction

1: Introduction

The health benefits of physical activity have long been recognised. Early studies by Morris, Heady, Raffle, Roberts and Parks (1953) reported lower rates of coronary heart disease in occupationally active workers. Subsequently Morris et al. (1973) reported the beneficial effects of vigorous leisure time activity. In 1978 Paffenbarger, Wing and Hyde, as part of the Harvard Alumni Health Study, reported a lower heart attack risk for those participating in regular physical activity, whilst activity levels remained high. Since then numerous long term studies have been conducted which have confirmed that regular physical activity contributes to the primary and secondary prevention of several chronic diseases.

In 2004 the Chief Medical Officer's report 'At Least Five A week' described the health benefits of physical activity and provided recommended activity levels for both adults and children which were the minimum requirements to promote and maintain health. Physically active adults were reported to have a 20-30% reduced risk of premature death and up to 50% reduced risk of developing major chronic diseases such as stroke, coronary heart disease, diabetes and cancers. For physically active children the range of health benefits includes healthy growth and development of the musculoskeletal and cardiorespiratory systems, maintenance of energy balance (which helps to prevent excess weight gain), psychological well being, and social interaction (Department of Health {DH}, 2004). Physical inactivity in childhood is a contributory factor to the rising levels of overweight and obesity among children, which presents serious health consequences, both during childhood and throughout life. There has been a rise in obesity from 11% of boys and 12% of girls in 1995 to 17% of boys and 16% of girls by 2007 (Health Survey for England, 2007) Obesity has been shown to

track into adulthood with 42-63% of obese school aged children becoming obese adults (DH, 2004).

The recommended physical activity levels for children suggest that children and young people should achieve a minimum of 60 minutes of at least moderate intensity physical activity each day. This 60 minute target may be achieved through the accumulation of bouts of activity of varying duration throughout the day (DH, 2004). The proportion of children achieving this level is unclear. Sleap and Tolfrey, (2001) found that all 9-12 year old children in their study met recommended amounts of PA. However many studies of similar aged children report varying proportions meeting these amounts, from 2.6% (Leary et al., 2008), 69% (Steele, van Sluijs, Cassidy, Griffin & Ekeland, 2009), 85% (Spinks, Macpherson, Bain & McClure, 2006) to 97% (Riddoch et al., 2004). The Health Survey for England 2007 reported that 72% of boys and 63% of girls aged 2-15 met recommended targets, with boys having similar levels of activity across the age groups, while for girls the proportion steadily declined after the age of nine. However, the proportion of children meeting recommended levels were reported to be as low as 32% of boys and 24% of girls by the Health Survey for England 2008, with girls' activity levels decreasing with age from 35% at age 2 to 12% at age 14.

Many children are still not meeting recommended activity levels (Spinks, Macpherson, Bain & McClure, 2006, Health Survey for England, 2007, 2008, van Sluijs, Cassidy, Griffin & Ekeland, 2009). This may be partly attributed to the decrease in active transport, over the past 25 years walking and cycling have both declined by 26% (DH, 2004), and the increase in sedentary recreational activities such as TV watching and electronic games. Active free play may also be hindered by lack of available areas and parental fears over safety, (Jago et al., 2009).

Physical inactivity not only presents health risks to the individual it is a major public health concern which results in an estimated annual cost to the NHS of between £1 billion and £1.8 billion (DH, 2009). A series of government initiatives have been implemented to increase physical activity levels of the nation including Choosing Activity (DH, 2005), Let's Get Moving (DH, 2009), and Be Active, Be Healthy (DH, 2009). The Change4Life campaign presents the simple message "eat well, move more, live longer" and provides advice on ways to promote a healthy lifestyle for families from birth throughout life.

Several programmes have been implemented which aim to increase physical activity more specifically among children. The Healthy Living Blueprint for schools (Department for Education and Skills {DfES}, 2004) has the objective "To promote high quality Physical Education and School Sport and promote Physical Activity as part of a lifelong healthy lifestyle." The Schools on the Move programme, (DH and Youth Sport Trust {YST}, 2007) aims to "help schools increase their pupils' levels of physical activity and awareness of the importance of physical activity in maintaining health and well-being." The added impetus of the 2012 Olympic Games in London has led to the development of the government funded initiative the PE and Sport Strategy for Young People (PESSYP, 2008), also described as the Five Hour Offer, which aims to increase the opportunities for children to participate in high quality PE and sport. It aims to build on the success of the National PE, School Sport and Club Links (PESSCL) Strategy, (Department for Children, Schools and Families {DCSF} and Department for Culture, Media and Sport {DCMS}, 2002) which resulted in a reported increase in the percentage of 5-16 year olds participating in at least 2 hours of high quality PE and school sport from an estimated 25% in 2002 to 86% in 2008. The PESSYP aims for children to participate in at least 5 hours of high quality PE and sport each week by 2011, with 2 hours being provided through the school PE curriculum, and additional hour from school based after school clubs and the remaining 2 hours from other organised sport.

The time spent at school represents a large proportion of the day for children. The teaching of PE is required throughout the primary curriculum. The National Curriculum (NC) programme of study for teaching PE at key stage 2, (KS2) places a strong emphasis on the development and application of skills, tactics and compositional ideas. Knowledge and understanding of health and fitness is required, however this is described as gaining an understanding of how activity affects the body in the short term, understanding that they should warm up and wear appropriate clothing, and that activity is good for health. There is no requirement for the children to be engaging in specific levels of activity during the lessons. Recommendations from DCSF and QCDA are for at least 75 minutes of curriculum time per week assigned to deliver the PE programme of study at KS2. The amount of physical activity that can be achieved through organised activities at school, PE lessons and after school clubs, is unlikely to be sufficient to meet the recommended guidelines. Further opportunities for engaging in physical activities during the school day exist during free play at break, lunch time and before the start of the school day, which may make a substantial contribution to total PA levels. Additionally, organised activities attended out of school together with home based free play may provide significant amounts of physical activity. The majority of initiatives to increase children's PA focus on organised activities, however the importance of free play has recently been recognised and in 2008 The Play Strategy (DCSF and Department for Culture, Media and Sport {DCMS}, 2008) was launched which aims to provide more safe outdoor play areas for children throughout the country.

To increase the likelihood of activity becoming a lifelong habit it is essential that healthy activity habits are established early in life (DH, 2005). In order for this to occur an understanding of the nature of children's PA behaviours is necessary. This study aims to determine the proportion of 10-11 year old children who are achieving the recommended 60 minutes of moderate to vigorous physical activity (MVPA) each day for one week during the

school term. It further aims to investigate the contribution to this total from activities in different domains. To compare PA achieved through organised activities both school based and out of school together with PA achieved through free play. Gender differences will also be investigated.

Chapter 2

Literature Review

2: Literature Review

2.1: Physical activity recommendations for children

Guidelines for the minimum amount of physical activity required to promote and maintain health have been set out by the Chief Medical Officer. The recommended physical activity levels for children suggest that children and young people should achieve a minimum of 60 minutes of at least moderate intensity physical activity each day. The 60 minute target should be achieved through the accumulation of bouts of activity of varying duration throughout the day (DH, 2004). For physically active children the range of health benefits includes healthy growth and development of the musculoskeletal and cardiorespiratory systems, maintenance of energy balance, which helps to prevent excess weight gain, psychological well being and social interaction (DH, 2004).

2.2: Health consequences of physical inactivity

The health consequences of physical inactivity have been widely documented. Warburton, Crystal, and Bredin (2006) conducted a comprehensive review of literature investigating the role of physical activity on health. They confirmed that there is irrefutable evidence that regular physical activity is effective in the primary and secondary prevention of several chronic diseases including cardiovascular disease, hypertension, diabetes, cancer, obesity, depression and osteoporosis and premature death. They concluded that physical inactivity is a major modifiable risk factor for these diseases.

2.2.1: Obesity

Physical inactivity during childhood presents both short and long term health consequences. The prevalence of childhood overweight and obesity has increased over the past few decades resulting in a global childhood obesity epidemic and a major public health concern (Wang & Lobstein, 2006). There has been a rise in obesity from 11% of boys and 12% of girls in 1995 to 17% of boys and 16% of girls by 2007 (Health Survey for England, 2007). Obesity in childhood often continues into adult life, with 42-63% of obese school aged children becoming obese adults (DH, 2004). Obesity is associated with insulin resistance, hypertension and dyslipidemia, which are all features of metabolic syndrome and risk factors for cardiovascular disease (Saland, 2007). Further short and long term health consequences of childhood obesity were described by Reilly et al., (2003) and Reilly, (2006). Short term consequences include psychological ill health, asthma, chronic inflammation, diabetes, orthopaedic abnormalities and liver disease. Consequences carried into adulthood include cardiovascular risk factors, adverse socioeconomic outcomes and premature mortality.

Although no single factor has led to this increase a relationship between physical inactivity and increase in obesity and associated chronic diseases in youth has been reported (Anderson & Butcher, 2006. Daniels et al., 2005). An inverse association (all $P < 0.01$) between time spent in objectively measured MVPA with measures of adiposity (waist circumference, fat mass index and body mass index) was reported by Steele, van Sluijs, Cassidy, Griffin and Ekeland (2009) in their study of 10 year old British children with a stronger association (all $P < 0.0001$) being observed for participation in vigorous physical activity (VPA). Physical activity (PA) was measured using the Actigraph accelerometer and data were included from participants who recorded at least 500 minutes per day on three or more days. Moderate physical activity (MPA) was defined as 2000-3999 counts per minute (CPM) and VPA defined as > 4000 CPM. They found that 69% of children were meeting the recommended 60

minutes of MVPA per day, and those meeting this level were 34% less likely to be overweight or obese.

Ness et al., (2007) carried out a cross-sectional analysis on 5,500 12 year old children. They found a strong negative dose-response association between objectively measured PA and DXA-derived measures of fat mass and obesity, which was stronger in boys than girls. The Actigraph accelerometer was used to record PA and data were used from children who had worn the Actigraph for at least ten hours per day for at least three days. MVPA was defined as 3600 CPM. The association between MVPA and fat mass was found to be stronger than that between total PA and fat mass. The authors also found that an increase of just 15 minutes of MVPA is associated with lower odds of obesity of over 50% in boys and nearly 40% in girls.

As cross sectional studies the above were not able to specify the direction of the association between physical activity and fat mass with the possibility that rather than physical activity preventing the development of obesity, obesity may lead to a reduction in physical activity. However, the latter is less likely as the association was seen across the range of fat mass rather than just in obese children. It is likely that a lack of physical activity contributes to the development of obesity which in turn results in reduced levels of physical activity, thus increasing the associated morbidity and mortality.

2.2.2: Cardiovascular Disease

The development of cardiovascular disease (CVD) may begin early in life. One of the major risk factors for CVD, elevated blood pressure (BP) has been reported in children, and BP levels have been shown to track into adulthood. Higher levels of PA were found to be associated with lower BP among children (Leary et al., 2008). Their study provided results from 5505 11-12 year old children whose PA was measured using the Actigraph

accelerometer. Data from those who had worn the accelerometer for at least 10 hours a day for at least three days were included. Total PA was measured and MVPA was defined as > 3600 CPM. They found that only 2.6% of children (5.1% of boys and 0.5% of girls) met the recommended amount of at least 60 minutes MVPA per day, with the median (Interquartile range {IQR}) amount being 20 (9.6, 37.8) minutes per day, 25.4 (15.7, 37.8) minutes per day for boys and 15.7 (9.6, 24.5) minutes per day for girls. They demonstrated an association between higher levels of PA and lower levels of BP. The observed associations were reported as -2.0 systolic blood pressure (SBP) mmHg and -1.6 diastolic blood pressure (DBP) mmHg per IQR change in total PA (240 CPM), ($P < 0.001$ for both). The results indicated that the volume rather than the intensity was the important factor. The authors suggest that increasing activity to the guideline amount would result in reductions of 1.8 mmHg (SBP) and 1.3 mmHg (DBP) and as these changes likely to track into adulthood this should contribute to a reduction in cardiovascular risk.

2.2.3: Insulin Resistance

A six year longitudinal study analysing the association between physical activity and indicators of insulin resistance among children and adolescents was conducted by Jago et al., (2008). Measurements were taken from 384 children at age 9, in 1997, and again at age 15, in 2003. PA was measured by accelerometer. Total activity, measured as mean CPM and MVPA, defined as minutes spent > 3000 CPM per day, were recorded. Both measures were required to determine whether it is the volume or intensity of PA which is important to insulin resistance. Data were included if at least 600 minutes per day on at least 3 days were recorded in 1997 and 2003. Levels of fasting insulin, fasting glucose and homeostasis model of assessment of insulin resistance (HOMA-IR) were obtained from blood samples. HOMA-IR was used as it provides a better indication of insulin resistance in youth than an oral glucose tolerance test. A significant ($P < 0.001$) drop in PA between 1997 and 2003 was

found. Mean (SD) CPM were 655 (± 234) minutes in 1997 and 440 (±164) minutes in 2003, Mean (SD) minutes > 3000 were 45 (±29) minutes in 1997 and 35 (±22) minutes in 2003. Fasting insulin levels were found to be negatively associated with both mean CPM and MVPA (z = -2.91, P = 0.004) and (z = -3.17, P = 0.002) respectively. Total activity and MVPA were also both found to be negatively associated with HOMA-IR, (z = -2.57, P = 0.010) and (z = -2.69, P = 0.007). The age related decline in PA seen from age 9 to age 15 was associated with adverse changes in fasting insulin and HOMA-IR. The data suggest that both the volume of activity and the intensity are important for the prevention of insulin resistance among adolescents. The authors concluded that preventing this age-related decline in PA may be an effective means of preventing insulin resistance in youth.

2.3: Physical activity levels

2.3.1: Proportion meeting recommended levels

The proportion of children achieving the recommended 60 minutes of MVPA each day is unclear. Interpretations of children's physical activity may depend on the methods of measurement and the thresholds used to define MVPA. Large variations in the proportion of children meeting recommended guidelines have been reported in studies measuring PA objectively using accelerometer, from 2.6% (Leary et al., 2008) to 97% (Riddoch et al., 2004). Leary et al., (2008) found that only 2.6% of 11-12 year old children (5.1% of boys and 0.5% of girls) met the recommended amount of at least 60 minutes MVPA per day. Van Sluijs et al., (2008) and Steele, van Sluijs, Cassidy, Griffin and Ekeland (2009) reported 69% of 10 year olds achieving recommended levels. Riddoch et al., (2004) reported that at age 9 97.4% of boys and 97.6% of girls achieved current health-related PA recommendations. Each of these studies used accelerometer recording for at least three days, however the cut off

points used to identify MVPA varied from > 3600 CPM (Leary et al., 2008), > 2000 CPM Van Sluijs et al., (2008) and Steele, van Sluijs, Cassidy, Griffin and Ekeland (2009) and > 1000 CPM (Riddoch et al., 2004).

The 2006 study by Dencker et al., of 229 Swedish children aged 8-11 years found that all the children were reaching the recommended levels. They described physical activity intensity as metabolic equivalents (METs), with time spent above three METs considered to be MPA and VPA described as time spent above six METs.

Sleap and Tolfrey, (2001) measured PA in 79 9-12 year old children using continuous heart rate monitoring and, using cumulative amounts of PA at intensities of > 120 beats per minute (bpm) and 75% above resting rate, reported all children meeting minimum daily recommendations. Spinks, Macpherson, Bain and McClure (2006) measured the PA levels of 518 Australian children aged 5-12 years using a 7 day diary which was completed by the parents. It was reported that 15% of children did not meet the minimum recommendations of 60 minutes of daily activity. The validity of the information collected by subjective methods of recording PA is influenced by the ability of the participant to accurately record all relevant details and by their opinion or perception (Corder, Ekelund, Steele, Wareham & Brage, 2008). Subjective measures of PA have been reported to be substantially higher than accelerometer measured activity. Troiano et al., (2008).

The latest available figures from the Health Survey for England, 2008 show that only 32% of boys and 24% of girls are meeting recommended levels of PA, with girls' activity levels decreasing with age from 35% at age 2 to 12% at age 14.

2.3.2: Decline in physical activity during adolescence

The decrease in activity among children as they enter the adolescent years has been well documented. (Riddoch et al., 2004. Jago, et al., 2008. Nader, Bradley, Houts, McRitchie & O'Brien, 2008. Pate, Dowda, O'Neill & Ward, 2007. Troiano et al., 2008. Wareham, Corder & van Sluijs, 2008.)

A dramatic decrease in accelerometer measured PA across age groups between childhood and adolescence was reported by Troiano et al., (2008). MVPA for youth was defined as activity of > 4 METs. 42% of children (48% of boys and 35% of girls) aged 6-11 years were shown to obtain the recommended 60 minutes per day of MVPA, whereas only 8% of adolescents (12% of boys and 3% of girls) aged 12-19 years met recommended amounts. The decrease was found to continue into adulthood. The authors report these figures to be substantially lower than those previously obtained by self-report methods.

Riddoch et al., (2004) measured PA levels of 2,185 children aged between 9 and 15 years from four European countries, as part of the European Youth Heart Study (EYHS) using accelerometers. MVPA was defined as activity > 3 METs which equated to cut off points of 1000 CPM at age 9 and 1500 CPM at age 15. They reported that at age 9 the great majority of boys (97.4%) and girls (97.6%) achieved current health-related PA recommendations. A marked reduction in activity over the adolescent years was found such that by age 15 fewer children achieved the guidelines and gender differences had become more apparent (boys 81.9% and girls 62.0%). This cross-sectional study demonstrated a decline in activity across age groups from 9 to 15 years; it is possible that some of the differences found may be attributable to differences between individuals in the sample.

Jago et al., (2008) conducted a 6-year longitudinal study in which activity levels were measured by accelerometer in the same cohort of children at 9 and 15 years. A large decline

in PA levels was found between these ages. CPM, used as an indicator of the volume of total activity, declined from a mean (±SD) CPM of 655 (± 234) at age 9 to 440 (±164) by age 15. Further, MVPA, defined with a cut-point of 3000 CPM, was shown to decline from 45 (±29) minutes at age 9 to 35 (±22) minutes at age 15. Additionally, by comparing the data from this study with previously published data from the same school, the authors were able to show that the decline in activity was age-related rather than due to a shift in culture between the recording dates.

The patterns of MVPA of youth were investigated by Nader, Bradley, Houts, McRitchie and O'Brien, (2008) who used data from the National Institute of Child Health and Human Development (NICHD) Study of Early Child Care and Youth Development which measured the accelerometer-determined minutes of MVPA of a large cohort at ages 9, 11, 12 and 15 years. A 3 MET cut off point was used to indicate MVPA. The results showed children engaging in approximately 3 hours per day of MVPA on both weekdays and weekend days at age 9, which decreased each year such that by age 15 MVPA levels had decreased to 49 minutes per weekday and 35 minutes per weekend day. This represented a drop from 100% achieving at least 60 minutes MVPA at age 9 on both weekdays and weekend days to only 31% meeting guidelines on weekdays and only 17% on weekend days by age 15.

The importance of establishing healthy physical activity patterns early in childhood is reported by Pate, Dowda, O'Neill and Ward, (2007) who demonstrated a decline in activity among girls from 45.4% in 8th grade (ages 13-14 years) to 34.1% in 12th grade (17-18 years) and further showed the strong association between participation in vigorous activity at 12th grade with participation in those activities at the earlier age. They concluded that participation in sports and other forms of vigorous physical activities early in life is important to the maintenance of physical activity during adolescence in girls.

2.4: Physical Activity Patterns and Opportunities

The time spent at school represents a large proportion of the day for children. Opportunities for engaging in physical activities within school are available through organised PE lessons and after school clubs as well as during free play at break, lunch time and before the start of the school day. Out of school opportunities for physical activity are also available from organised activities and free play.

Gidlow, Cochrane, Davey and Smith, (2008) have compared the in-school and out-of-school PA of 3-16 year olds. PA was measured using accelerometers. Average in-school activity levels, measured as CPM, were lower than out of school activity levels overall. For primary school children mean (± SD) CPM in-school was 510.7 (±148.5) compared to 571.4 (±197.4) out-of-school, ($P < 0.001$). In-school activity was shown to account for approximately 30% of children's total weekly MVPA. The results of proportion of children meeting recommended guidelines vary greatly depending on the definition of cut off points used to define MVPA. When age specific thresholds were used as described by Trost et al., 2002, (for example CPM > 990 at age 10 and CPM > 1107 at age 11), 100% of primary school children were shown to meet achieved recommended levels. When the alternative intensity thresholds, described by Puyau, Adolph, Vohra, and Butte, 2002, of CPM > 3200 were applied less than 4% met recommended levels.

2.4.1: School lessons

Fairclough and Stratton, (2004) assessed PA levels during school PE lessons using heart rate telemetry. When all PE activities were considered together, children engaged in MVPA for 34.3% (±21.8%) of PE time. This equated to 17.5 (±12.9) minutes MVPA. The high sporting ability students were found to be most active. Participation in MVPA was highest for team games (43.2 ±19.5%) and lowest for movement activities (22.2 ±20.0%). Given the

infrequency of school PE lessons, they are unable to provide a significant contribution to meeting recommended activity levels.

The teaching of PE is required throughout the primary curriculum. Recommendations from the DCSF and the QCDA are for at least 75 minutes of curriculum time per week to be assigned to deliver the PE programme of study at KS2. Government aims to increase PA among children often focus on school sport. The DCSF and DCMS, have set aims for at least 2 hours of high quality PE and sport each week to be delivered through school curriculum PE as part of the PE and Sport Strategy for Young People (PESSYP).

The PA levels of primary school children were monitored by direct observation during PE lessons, break times and lunch times over a sustained period, 30,650 minutes (Waring, Warburton & Coy, 2007). Moderate activity was determined as equivalent to brisk walking and vigorous activity was at least equivalent to slow jogging. Participation in MVPA was low across all PE curriculum areas. Mean minutes (±SD) engaged in MVPA were 6.82 (±3.3) minutes for observation time of PE lesson of 36.9 minutes. 44% of the lessons observed lasted for less than 30 minutes and on average children engaged in MVPA for 14% of the total time. At break time boys spent 20% of their time in MVPA, whilst girls spent 13%. At lunch time an average of 11% of total time was spent in MVPA. Overall during the school day children were engaged in MVPA for 11.8% of the total observed time. Conclusions drawn from this study are that 'the school is not delivering on its potential to be an effective setting to promote physical activity.' Improvements to both curriculum PE, to address the PA content of PE lessons, and areas and facilities available during break and lunch to promote PA need to be made.

The effect of school based PA on academic performance has been investigated by Ahamed et al., (2007) and Trudeau and Shepard, (2008). Both studies showed that extra time spent in PA

at school did not affect academic performance, even though time allocated to other subjects was correspondingly reduced.

2.4.2: School Free Time

The review of studies investigating PA during playtime by Ridgers, Stratton and Fairclough, (2006) report that although playtime offers the opportunity for children to be physically active during the school day, it is only recently that research has attempted to quantify children's activity levels during playtime and their contribution towards physical activity guidelines. When no playtime interventions were used, playtime was shown to contribute between 5-40% of recommended daily PA levels. An increase in energy expenditure and physical activity levels during playtime when playtime-based interventions were implemented was reported, with levels of VPA increasing by 60%.

Further recent studies investigating children's PA during free time at school and the effects of playground interventions have also found positive results. Ridgers, Stratton, Fairclough and Twist, (2007) investigated the effect of playground markings and physical structures on MVPA during break at 26 primary schools. PA was measured by accelerometer at baseline and again six weeks following the interventions. Small but non-significant increases (4.5%, P = 0.112) in MVPA were found following the interventions.

The effectiveness of two interventions on children's PA during the 20 minute school break was examined by Loucaides, Jago and Charalambous, (2009). PA was measured using pedometers before and four weeks after the interventions. Each intervention took place at a different school a third school served as control. The first intervention allocated areas to different children on alternate days, with playground markings and jump ropes provided. The second intervention just allocated areas to different children on alternate days. Pedometer counts for break time were recorded and in addition, in order to determine if a change in PA

during break affects after school PA, steps from end of school to bed time were also recorded. Following intervention the mean (±SD) steps during break were higher in intervention school one (1427 ±499) steps and intervention school two (1331 ±651) steps than the control school (1053 ±447) steps, ($P < 0.001$ and $P < 0.01$ respectively). Differences were not present pre-intervention. No difference was found between the two intervention schools, ($P = 0.50$). After school PA was also increased for children in intervention school one (9.2%) and intervention school two (2.4%) though non-significantly, while children in the control group had decreased their steps by 1.9%. This is in contrast to the findings of the review by van Sluijs , McMinn and Griffin, (2007) who found that increased PA at school was compensated for by reduced activity away from school.

The effect on PA of permanent play facilities in school playgrounds was investigated by Neilsen, Taylor, Williams and Mann, (2010). PA was measured using accelerometers with MVPA defined as CPM > 1500. Data were analysed from 417 children aged 5 to 12, from seven primary schools, who had at least two days of 12 hours valid recordings, from 8 AM to 8 PM with school time classified as 9 AM to 3 PM. More than 4 hours per day MPA and an additional 17 to 20 minutes VPA were recorded. In girls mean activity counts per day decreased with age (4% decline per year of age, $P = 0.005$). The number of permanent play facilities (adventure playgrounds, swings, trees, playground markings, courts and basketball hoops) at the schools ranged from 14 to 35. There was a consistent positive association between the number of play facilities and activity levels, both at school and for total activity. For each additional play facility average CPM during school hours were 3.8% higher. Children also spent more time in MPA (1.9%, $P = 0.003$) and VPA (10.1%, $P = 0.001$). This equated to an extra 4 minutes MVPA per extra play facility during school time and an extra 9 minutes MVPA throughout the day. The increase in PA during school time was not compensated for by decreased PA after school.

The large scale study of McKenzie, Crespo, Baquero and Elder, (2010) adds further evidence to the positive effect of playground equipment on PA. 36,995 children were observed, before school, during break and lunchtime, over 2,349 visits to elementary schools. Organised activities were provided 16.5% of the time. Children engaged in a substantial amount of PA and MVPA during their free time at school, with boys spending 66.2% of their free time in MVPA and girls 60.0%. In areas with play equipment the odds of engaging in MVPA were greater, ($P < 0.05$).

2.4.3: Out of school Activities

Factors which affect children's independent activity out of school have been investigated by Veitch, Salmon and Ball, (2008 and 2010). The first study used maps and surveys to determine the areas where children engage in PA in their free time and the furthest distance the children were allowed to cycle or walk without an adult. Two hundred and twelve children aged between 8 and 12 took part. The yard or garden at home was the most frequently reported place for PA, (48%) followed by a park or playground, (37%) and a friend's or relative's garden, (26%). Under half of the children aged 10 to 12 were allowed to travel more than 1000m from home without an adult, and overall 12% were not allowed to travel anywhere without an adult. The authors suggest that parental concerns over safety may be restricting their children's independent mobility, which in turn restricts the time spent being active outdoors. The second study examined associations between individual, social and physical environmental factors and the frequency with which children play outdoors outside school time. It also investigated whether the frequency of outdoor play was associated with overall PA levels. Surveys were used to assess outdoor play and PA was measured using accelerometers. Data from children with at least four days and 10,000 counts per day were included, MVPA was determined as ≥ 3 METS. Factors which were associated with increased active outdoor play were parent's perceptions that it was safe for their child to play

in the street, having many friends in the neighbourhood and living in a cul-de-sac. No significant differences were found in PA levels of children with the highest and lowest frequencies of outdoor play.

Jago et al., (2009) examined parental attitudes to their children's independent activity. Twenty four parents of 10-11 year old children were interviewed by telephone. The children's independent activity was limited by parent's perceived lack of appropriate spaces, concerns about safety and traffic, the lack of local friends and the presence of older children. The parents indicated that the end of primary school would be the period when they would begin to allow their children to become more independently active.

Time spent outdoors was shown to be associated with higher levels of activity by Wheeler, Cooper, Page and Jago, (2010) in their study which measured the volume and intensity of children's activity in greenspace and elsewhere. PA was measured in 10-11 year old children using accelerometers, with MVPA defined as ≥ 3200 CPM. Location was measured after school by Global Positioning System (GPS) receivers. Children were found to spend approximately 13% of their after school time outdoors, but 30% of activity volume and 35% MVPA occurred outdoors. Most outdoors activity took place in areas other than greenspace, but activity in greenspace tended to be more intense, particularly for boys. The authors conclude that both the built environment and greenspace play an important role in supporting children's PA.

The contribution that unstructured outdoor PA ("active play") out of school time can contribute to overall PA was investigated by Brockman, Jago and Fox, (2010). Participants were 747 10-11 year olds. PA was measured using accelerometers and mean activity levels (CPM) and minutes of MVPA, defined as ≥ 3200 CPM, were calculated. Leisure time PA was defined as 3 pm to 6 pm on weekdays and all day at weekends. Data were included from

children with at least 3 days recordings of ≥ 500 minutes per day. Girls who engaged in active play more frequently (≥ 5 days per week) had higher mean activity levels (555.6 CPM) and minutes of MVPA on weekdays (37.4 minutes MVPA) than those who engaged in active play less frequently (≤ 2 days per week), (473.4 CPM, and 30.7 minutes MVPA respectively), (both $P < 0.01$) but no differences were found between the groups at weekends. For boys mean activity levels were greater for those who engaged in active play more frequently on both weekdays (642.3 CPM, vs 570.2 CPM, $P < 0.01$) and weekends (680.8 CPM vs 539.1 CPM, $P < 0.01$). Active play after school was shown to make a significant ($P < 0.05$) contribution to MVPA of many primary school children.

There are multiple factors which influence children's activity. During school time the provision of suitable play areas and facilities for use during breaks as well as the amount and quality of the PE lessons and other organised activities can have substantial effects on activity levels. Out of school the main limiting factor to children's independent activity appears to be parents' concerns about safety issues.

Chapter 3

Rationale and Research Questions

3: Rationale and Research Questions

3.1: Rationale

Physical inactivity has long been recognised as a modifiable risk factor for several chronic diseases. The health consequences of physical inactivity among adults have been widely reported since the early work of Morris, Heady, Raffle, Roberts and Parks (1953). In comparison investigations into physical activity habits and health consequences of inactivity among children are relatively recent. Increasing evidence is emerging of both the short and long term consequences of inactivity among children. The recommended amount of physical activity for children and adolescents is for at least 60 minutes of at least moderate intensity physical activity per day (DH, 2004). The proportion of children achieving this level is unclear. Reported levels of the proportion of children meeting recommended guidelines vary from 2.6% (Leary et al., 2008) to 97% (Riddoch et al., 2004) for objectively measured PA. Activity patterns of children have been shown to vary by day and time of day, (Jago, Anderson, Baranowski and Watson, 2005). Activity levels of children as they approach the end of primary school are of particular interest as the decline in activity as children enter adolescence is well documented. (Riddoch et al., 2004. Jago, et al., 2008. Nader, Bradley, Houts, McRitchie & O'Brien, 2008. Pate, Dowda, O'Neill & Ward, 2007. Troiano et al., 2008. Wareham, Corder & van Sluijs, 2008.) Many factors influence children's activity, including the opportunities available both at school and home for organised activities and free play. Few studies have investigated the relative contributions to total daily MVPA of activity achieved through each of the different categories per day over the course of a week.

3.2: Research Questions

3.2.1: Primary Research Question

What proportion of 10-11 year olds are undertaking sufficient MVPA each day during the school week to meet recommended levels of at least 60 minutes MVPA per day?

3.2.2: Secondary Objectives

To determine the contribution to total daily MVPA achieved through:

- organised activities and free play
- school based and home based activities

To investigate gender differences.

3.3: Aims

The purpose of this study is to determine whether the majority of primary school children aged 10-11 years are undertaking sufficient physical activity to promote and maintain health and to determine differences by day throughout a school week. This study further aims to investigate the different areas where MVPA is being achieved. To compare MVPA achieved through organised activities both school based and out of school together with MVPA achieved through free play. Gender differences will also be investigated.

Chapter 4

Methods

4: Methods

4.1: Participants

Permission was granted from two primary schools to conduct the study at the schools and to approach the parents of the Year 6 children, aged 10 – 11 years, to invite their children to take part in the study (Appendix A). Details of what would be required should they take part in the study were given when the study was described to the children and teachers. The children were given the opportunity to ask questions. Each child was given a letter of invitation (Appendix B), a participant information sheet (Appendix C) and a participant consent form (Appendix D) to take home to their parents informing them of the nature of the study and requesting permission for their children to take part. Informed consent was requested from parents when both they and their children were happy to take part in the study. Invitations to take part were sent to 128 children (60 boys and 68 girls). Informed consent was received from 72 (27 boys and 45 girls).

This study was approved by the Research Ethics Committee of the Faculty of Applied and Health Sciences at The University of Chester.

4.2: Physical activity assessment

4.2.1: Choosing assessment method

Many methods of measuring physical activity are available, both objective and subjective, including double labelled water (DLW), pedometry, accelerometry, heart rate monitoring,

activity diaries and questionnaires. The advantages and disadvantages of the different methods for varying studies have been reviewed by Vanhees et al., (2005) and the Medical Research Council (MRC). Corder, Ekelund, Steele, Wareham and Brage, (2008) reviewed physical assessment methods in youth. Findings from the above are summarised in the following table.

Table 1: Advantages and disadvantages of physical activity assessment methods

Assessment method	Advantages	Disadvantages
Double labelled water (DLW)	Suitable for children and adults Accurate and valid measurement of TEE Does not interfere in participant's daily activity	Expensive Does not measure specific activities Does not assess intensity, frequency, duration or domain of activity
Pedometers	Suitable for children and adults Inexpensive and easy to use Low participant burden	Measures only walking or running Does not measure specific activities Does not assess intensity, frequency, duration or domain of activity
Accelerometers	Suitable for children and adults Able to detect change in activity Able to record for extended periods Provides data on intensity of activity	Not used for water based activities Unable to record upper-body movement, cycling, carrying a load Limited validity for estimating EE

Table 1 continued

Assessment method	Advantages	Disadvantages
Heart rate monitoring	Suitable for children and adults Lightweight and portable HR directly related to PA at high levels of activity	HR not closely related to EE at low levels of activity Other factors affect HR Individual calibration required
Questionnaires	Suitable for children and adults – children may need proxy Inexpensive Can assess a variety of variables Able to provide data on intensity, frequency, duration, type of activity and domains	Subject to recall errors Subject to social desirability bias Unable to estimate EE
Diaries/Logs	Suitable for children and adults Provide detailed information about all PA undertaken in a day Can quantify bouts of activity Can identify patterns of behaviour Does not rely on recall or memory Inexpensive	Subject to reactivity effect Influenced by participants perceptions Data processing is complex and time consuming

TEE = total energy expenditure, EE = energy expenditure, HR = heart rate

Several methods of measuring children's physical activity were examined for suitability for this study. A method suitable for use in a large number of children over an extended time period which recorded intensity, frequency, duration and type of activity together with details of the domains in which the activities occurred was required. Additionally the method would need to be non invasive and not present a great burden on the participants. Objective methods

of measuring PA are not able to provide details of the activity domains. A subjective method was therefore required. This includes activity questionnaires, diaries and logs.

4.2.2: Activity questionnaires and diaries

The advantages of self-report measures of physical activity include low cost and ease of administration, the ability to record the context in which the activity occurred and a relatively low participant burden (Janz, Lutuchy, Wenthe & Levy, (2008). However, they may be subject to a reactivity effect where the act of monitoring activity causes the individual to increase their activity. Furthermore, the validity of the information collected by such methods is influenced by the ability of the participant to accurately record all relevant details and by their opinion or perception (Corder, Ekelund, Steele, Wareham, & Brage, 2008). The age of participants must be considered when choosing a suitable method. The validity of 30 questionnaires and diaries used to measure PA in children and adolescents was reviewed by Tessier, Vuillemin and Briancon, 2007. The most reliable and valid for use by children were found to be the Physical Activity Questionnaire for Children (PAQ-C) and the Previous Day Physical Activity Recall (PDPAR).

The main features of questionnaires and diaries designed for children and considered for this study are summarised below.

The Physical Activity Questionnaire for Children (PAQ-C) provides a summary of the previous 7 days activity from recall. Scores are derived from 9 questions, each of which is scored on a 5 point scale. It is suitable for ages 8 -14 and determines MVPA over 7 days, however is not suitable for this study as it assesses general PA not specific frequency, time and intensity. (Kowalski, Crocker & Faulker, 1997, Janz, Lutuchy, Wenthe & Levy, 2008).

The Multimedia Activity Recall for Children and Adolescents (MARCA) is a one day self-report recall questionnaire administered by computer. It requires recall of children's previous day's PA in time slices of 5 minutes or more. This allows for activities of short duration to be included. It provides detail on type, intensity, duration and frequency of activity and includes information as to the activity domain. This study requires recording of PA for 7 days which with 5 minute intervals would be a large burden for the participants. Additionally it requires the access to computers for all participants each day, which was not available. Few studies have assessed the validity of the MARCA. Ridley, Olds and Hill, (2006) reported acceptable validity however they used a very small sample of only 32 children.

The machine-readable School Health Action, Planning and Evaluation System (SHAPES) method is designed for school children from age 11. It requires multiple choice answers to 45 questions covering the previous 7 days PA as well as attitudes to activity, friendships and smoking. (Wong, Leatherdale & Manske, 2006) It has been shown to have acceptable reliability and validity. This study requires more detailed information on the individual activities.

The Child/Adolescent Activity Log (CAAL) has been shown to have validity and reliability for use in children from age 10. It is completed as a recall log and contains 21 activities which the child indicates whether or not they engaged in the previous day together with the duration of each activity. It does not present a large burden for the participants as it can be completed in 5 minutes each day. However, it would not provide the level of detail required for this study (Garcia, George, Coviak, Antonakos & Pender, 1997).

The Bouchard 3-day Activity Diary was designed to be used children from age 10 to adults of 50. The diary divides the day into 96 periods of 15 minutes. Activities are categorised between 1, resting and sleeping to 9, high intensity work or sport. For each period the

participant enters a categorical value corresponding to the dominant activity for that period. Measurements of body weight are required to calculate energy expenditure (Bouchard et al., 1983). It has been shown to have reasonable validity to assess PA in adolescents (Martinez-Gomez et al., 2010). This study requires a simpler recording system which details activities individually.

The Previous Day Physical Activity Recall (PDPAR) has been shown to be a valid method for measuring physical activity in children and adolescents. (Weston, Petrosa & Pate, 1997. Trost, Ward, McRaw & Pate, 1999. Welk, Dzewaltowski & Hill, 2004. Anderson, Hagstromer & Yngve, 2005, Tessier, Vuillemin & Briancon, 2008). It is designed to record activities in 30 minute blocks as recall from the previous day following school from 3.30 pm to 11 pm. Common activities are entered from a numbered list, others are described on entry. Intensities of activities are described as very light, light, medium and hard. The main activity for each block is recorded together with the intensity. Anderson, Hagstromer and Yngve, (2005) suggest that the recording of activities in 30 minute blocks and selection of a main activity for each block may result in intermittent activities being missed or overestimation of activity. However, they showed a higher correlation between PDPAR and accelerometer measured PA when the PDPAR was used as a diary rather than a recall instrument.

The PDPAR has many of the features required for this study including the intensity, frequency, duration and type of activity. It was possible to adapt it for use as a diary to be used each day for one week and to add categories for the activities. The 30 minute blocks may mean that activities of short duration are either not recorded or over reported. However reducing the time period would increase the burden on the participants and a balance between validity and feasibility was required.

4.3: Physical activity diary

Physical activity was assessed by self report using an activity diary adapted from the PDPAR (Appendix E) to enable a detailed record of activities throughout the day to be provided. Information about the intensity, frequency, duration and type of the activities undertaken together with details of the various categories were recorded. It enabled patterns of activity to be identified.

Adaptations to the PDPAR were required for this study as follows:

- The language and examples of activities have been altered slightly for the British children
- The recording time has been extended to include the whole of the waking day
- Categories have been added to determine the domains of the activities
- The day has been divided into sections to make it easier for the children to use and to increase accuracy
- The activities were recorded as they occurred throughout the day rather than as recall so that the children did not have to rely on memory

The physical activity patterns of children vary from day to day and by time of day (Jago, Anderson, Baranowski & Watson, 2005). School PE lessons generally take place on set days each week, as do most organised activities. To take account of these variations and provide more detailed information the diaries were completed each day for one week during the school term. To include the whole of the waking day activities were recorded from 7 am to 10 pm each day. Four activity categories were used.

1) School clubs, to include all organised activities that took place at school including PE during the school day and after school clubs.

2) School free, to include all activity that took place within the school premises during free time, before the start of the school day, at break and at lunch.

3) Home clubs, to include all organised activities outside of school.

4) Home free, to include all free time activities outside of school.

On school days 'home clubs' and 'home free' took place from waking until arriving at school and from arriving home until bedtime. At the weekend they were from waking until bedtime.

Time was allowed during the school day for the diaries to be completed.

4.4: Experimental design

The diaries were introduced to the children and teachers at the start of the school day on the Monday of the week of recording PA. Clear, detailed explanations as to how they should be completed were given. The timings required and the activity levels were discussed and several examples given (Appendix F). Emphasis was placed on:

- Recording the main activity for a given time period
- Understanding the different levels of activity
- Understanding that a given activity may be performed at different levels
- Recording where the activity took place

To ensure understanding examples of activities often undertaken by the children were sought and discussions of how these should be recorded were conducted. Completing a day of the diary was then modelled with interaction from the children.

An example of a completed diary was given and written instructions were also provided to ensure that the diaries were completed accurately throughout the week. Poster sized instructions and examples were also supplied for display within the classrooms. The children and teachers were given the opportunity to ask questions. Contact details were given so that any queries which developed during the week could be answered. The schools were contacted regularly during the week to check for any issues.

The diaries were collected the following week. On collection the diaries were assigned identification numbers and the children's names were removed to provide anonymity. The diaries were checked for missing or unclear entries and the children were asked for clarification where possible. Children were asked if there were any reasons why they may not have engaged in their normal level of activity, for example due to illness or injury.

4.5: Data Analysis

Diaries were included in the final analysis if seven full days of recordings were provided and the child was able to perform their normal level of activity each recording day. The diary entries were in 30 minute blocks of activity. The numbers of 30 minute blocks were counted for each activity level each day and for MVPA for each activity category for each day. The blocks were converted into minutes of activity at each level, very light, light, moderate and vigorous. The minutes of MVPA were also determined in total per day and for each activity category, organised at school, free play at school, organised at home, free play at home.

The data were entered into Excel spreadsheets and transferred to SPSS for Windows (version 14) for analysis. Significance level was set at $P \leq 0.05$.

Descriptive statistics and percentages were used to determine the number and proportion of children who met recommended guidelines of at least 60 minutes of MVPA per day. Cross tabulation and Chi Square tests were conducted to investigate gender differences.

The time spent in MVPA for each of the activity categories was determined per school day and per weekend day. School days were analysed separately from weekend days. No school activities took place at the weekends and the amount of time available for PA was greater. This enabled a more accurate comparison of the activities which took place during and outside school.

A large number of responses, between 10 and 41%, in each activity category had a value of zero. Many of the categories were not normally distributed, (Shapiro-Wilk < 0.05). The median (range) were therefore determined for each category each day and the non parametric Wilcoxon and Mann Whitney U tests performed to determine differences between the categories and between the genders. However the large number of zero responses resulted in several of the median values of the categories, particularly for organised activities, also being zero, although the ranges were large. Meaningful calculations could therefore not be performed.

When the data were calculated by gender and for school day and weekend day several of the categories were either normally distributed or approximated to normal distribution (Appendix G). Additionally, Jago et al., (2008) reported results as mean (±SD) for physical activity data which was not normally distributed. Therefore, the results were reported as mean (±SD) and the parametric tests were conducted.

The paired t-tests were performed to determine differences in time spent in MVPA between the different categories.

The independent t-tests were performed to determine gender differences for the different categories.

Percentages were calculated to determine the proportion of total daily MVPA spent in each category. On school days the contributions to daily MVPA of total in school and out of school activities, and total clubs and total free play were also calculated.

SPSS output is shown in Appendix G.

Chapter 5

Results

5: Results

5.1: Participants

Participants were required to complete activity diaries each day for one week during the school term. The diaries were completed from 7 am to 10 pm in order to cover the whole of the waking day. Activities were recorded in 30 minute blocks, and the level of intensity of the activity and the domain in which it occurred were recorded.

A total of 128 invitations to take part in the study were sent to the parents of Year 6 children, aged 10 – 11, at two primary schools. Informed consent was received from the parents of 72 children. Of the 72 (girls=45, boys=27) diaries returned 53 (girls=35, boys=18) were included in the final analysis. Diaries were excluded for the following reasons:

- the diaries were incomplete (n=9)
- the diaries were not completed to a satisfactory standard (n=7)
- the child was unwell for some or all of recording period (n=2)
- the child was unable to exercise due to injury (n=1)

5.2: Proportion achieving recommended activity levels

The numbers and proportions of children achieving the recommended 60 minutes of MVPA were determined for each recording day.

Table 2: Number of children achieving recommended amounts of MVPA each day

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
Achieved	39	41	43	44	41	41	34
Not Achieved	14	12	10	9	12	12	19

It was found that the number of children, from the sample of 53, achieving recommended activity levels varied between 34 on Sunday to 44 on Thursday.

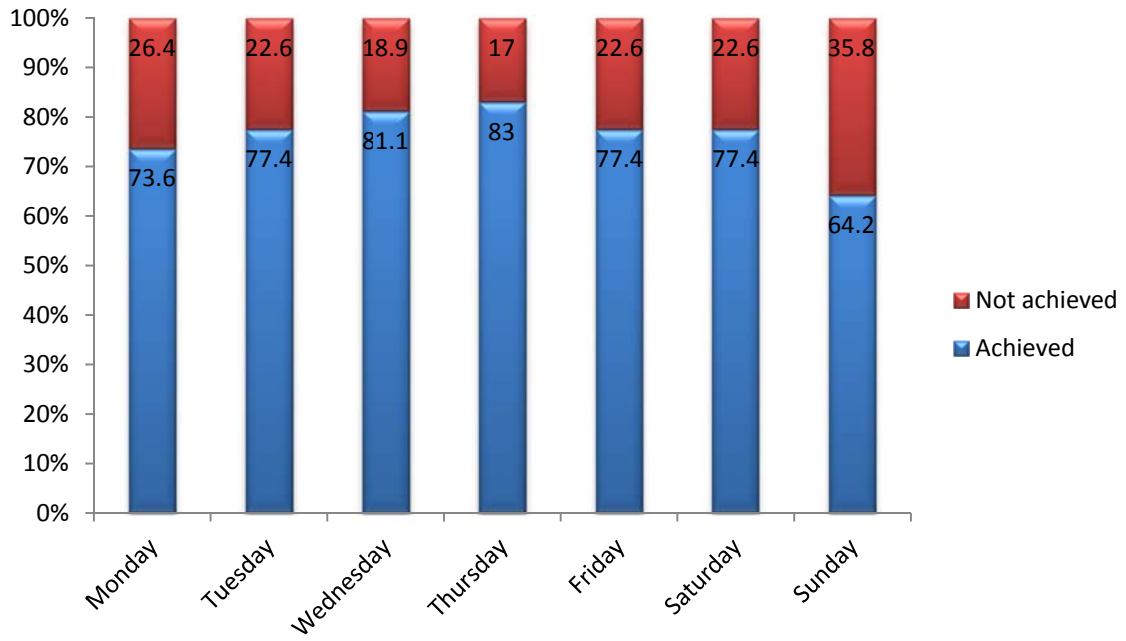

Figure 1: Proportion of children achieving recommended amounts of MVPA each day

The proportion of children meeting the current recommended guideline amount of 60 minutes of MVPA each day was shown to range from 64.2% on Sunday to 83.0% on Thursday. On three days of the week 77.4% met recommended levels.

When the data were analysed further to determine whether or not it was the same children who did not achieve the recommended amount of MVPA it was found that 17 children (32.1%) did not achieve this level on three or more days during the week. Within that group 2 (3.8%) did not achieve this level on any day.

The average proportion of children achieving recommended levels of MVPA was determined per school day, per weekend day and per day.

Table 3: Proportion achieving recommended MVPA levels per school day, weekend day and daily

	School days	Weekend days	Daily
Achieved	78.5%	70.8%	74.7%
Not achieved	21.5%	29.2%	25.3%

More children were achieving recommended MVPA on school days (78.5%) than on weekend days (70.8%). This is mainly due to the large decrease in the numbers achieving recommended levels on Sunday, when only 64.2% (34 children) met this level. On all other days between 73.6% (39 children) and 83.0% (44 children) were achieving recommended levels. The proportion achieving recommended levels per day throughout the week was 74.7%.

The data were derived from self-report activity diaries divided into 30 minute time blocks and activities were recorded as the main activity undertaken within each block. Recommended levels were shown to be achieved when two of these blocks (60 minutes) recorded MVPA.

However this could have resulted in an overestimation of the proportion achieving recommended levels. The school break time, for example, was generally recorded as a block of MVPA. This was the correct method of recording when the activity was the main one for that block. However break was no more than 20 minutes long and this included the time to tidy work away, walk to the playground and line up and return to the classroom at the end of break. This pattern was repeated at other times of day. In order to reduce the effect of possible over recording it may be more accurate to count three blocks of MVPA to represent achieving the recommendation of at least 60 minutes as each block should represent participation in 20 minutes MVPA.

The following results were produced when the data were reanalysed using three blocks as the cut off point to indicate achieving recommended levels.

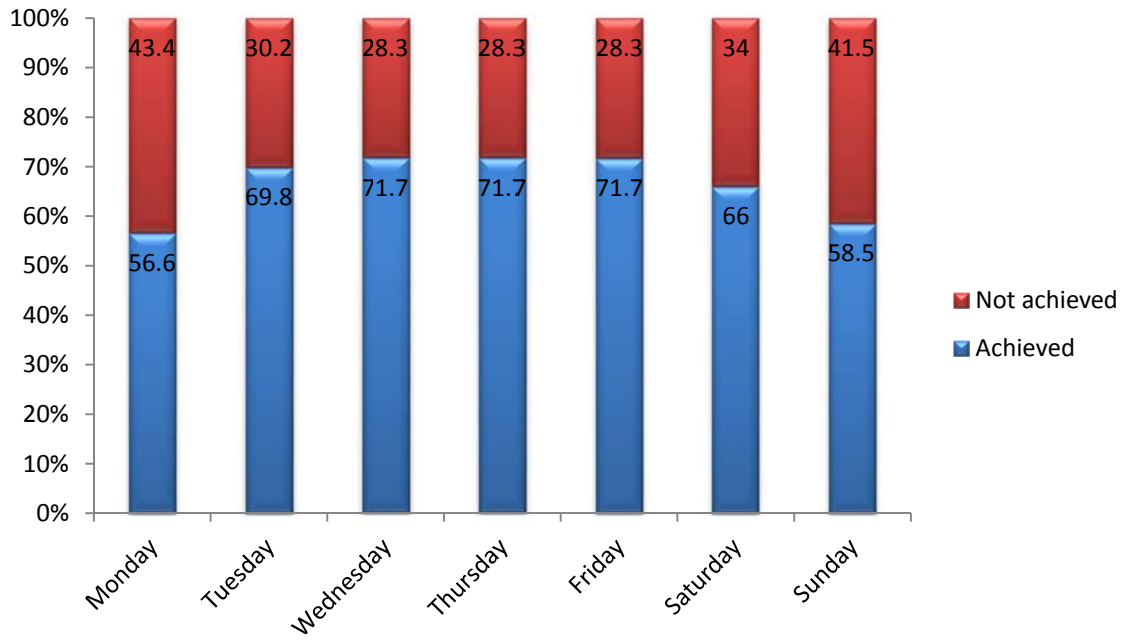

Figure 2: Proportion of children meeting recommended levels of MVPA per day from alternative cut off point

The average proportion of children achieving recommended levels of MVPA was determined per school day, per weekend day and per day for the alternative cut off point.

Table 4: Proportion of children meeting recommended levels of MVPA per school day, weekend day and day from alternative cut off point

	School days	Weekend days	Daily
Achieved	68.3%	62.3%	66.6%
Not achieved	31.7%	37.7%	33.4%

Using the alternative cut off point of three blocks to indicate meeting recommended activity levels the proportions achieving this level were found to range from 56.6% on Monday to 71.7% on Wednesday, Thursday and Friday. The proportion achieving on a school day (68.3%) was greater than that achieving on a weekend day (62.3%). The proportion achieving recommended levels per day throughout the week was 66.6%. Further analysis revealed 39.6% (21children) not meeting levels on three or more days.

More detailed examination of the data shows very large variations in the amount of time spent in MVPA for different children. On any day of the week a number of children have recorded spending no time in MVPA. However, some children have recorded substantial amounts of time spent in MVPA, the maximum being 420 minutes on a school day and 480 minutes on a weekend day. It is likely that there has been overestimation of activity by some children. The data were therefore reanalysed after removal of the outliers. The new file, data set 2, contained 31 records, (boys = 9, girls = 22). Summary results are presented here for comparison.

Table 5: Proportion of children meeting recommended levels of MVPA following reanalysis after removal of outliers

	School days		Weekend days		Daily	
Cut off point*	2	3	2	3	2	3
Achieved	69.0%	56.2%	53.2%	42.0%	64.5%	52.1%
Not achieved	31.0%	43.8%	46.8%	58.0%	35.5%	47.9%

*Number of time blocks used to indicate achieving recommended levels

Following reanalysis after removal of the outliers, lower proportions were shown to be meeting recommended levels each day; however the patterns were the same. More children were achieving recommended levels on school days (2 blocks = 69.0%, 3 blocks = 56.2%) than weekend days (2 blocks = 53.2%, 3 blocks = 42.0%). The proportion achieving recommended levels per day throughout the week was 64.5%, when 2 time blocks were used as the cut off point and 52.1% when 3 time blocks were used.

5.3: Comparing organised activities with free play

The numbers of minutes spent in the different activity categories, organised and free play at school and home, were determined for each day of the week. The four activity categories were:

1) School clubs, to include all organised activities that took place at school including PE during the school day and after school clubs.

2) School free, to include all activity that took place within the school premises during free time, before the start of the school day, at break and at lunch.

3) Home clubs, to include all organised activities outside of school.

4) Home free, to include all free time activities outside of school.

On school days 'home clubs' and 'home free' took place from waking until arriving at school and from arriving home until bedtime. At the weekend they were from waking until bedtime.

Table 6: Minutes MVPA achieved through organised activities and free play each day. Mean (±SD)

Category	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
School clubs	22 (29.1)	10 (28.2)	13 (23.2)	11 (25.7)	16 (26.0)	n/a	n/a
School free	28 (27.5)	31 (28.2)	36 (28.2)	35 (31.5)	33 (29.8)	n/a	n/a
Home clubs	10 (31.1)	25 (50.2)	15 (39.3)	22 (60.0)	15 (38.4)	31 (86.0)	21 (61.9)
Home free	47 (59.9)	52 (55.9)	69 (75.5)	68 (73.5)	62 (65.2)	132 (112.0)	98 (110.9)
Total	107 (79.9)	118 (80.2)	133 (96)	136 (94.8)	126 (92.0)	163 (127.5)	119 (113.9)

Organised activities accounted for less MVPA than free play on each day of the week. Time spent in MVPA from school based clubs varied from 10(28.2) minutes on Tuesday to 22(29.1) minutes on Monday. Out of school clubs on school days accounted for between 10(31.1) minutes on Monday to 25(50.2) on Tuesday. MVPA from in school free play was

less than that from out of school free play on each school day. Total activity per day varied from 106(79.9) minutes on Monday to 163(127.5) minutes on Saturday.

The data were further analysed per school day and per weekend day to determine the significance of the differences between the categories, between the school and weekend days and between in school and out of school activities.

Table 7: Minutes MVPA within each category per school day and per weekend day. Mean (±SD)

Category	School day MVPA	Weekend day MVPA
School clubs	14(15.9)	n/a
School free	33(25.1)	n/a
Home clubs	17(27.2)	26(65.6)
Home free	60(53.3)	114(101.6)
Total in school	47(27.7)	n/a
Total out of school	77(57.3)	n/a
Total clubs	32(30.4)	26(65.6)
Total free	92(72.3)	114(101.6)
Total	124(72.8)	140(108.2)

Paired t tests revealed significant ($P < 0.05$) differences between free play and organised activities both in school and out of school. During school significantly more time was spent in MVPA through free play, 33(25.1) minutes than organised activities, 14(15.9) minutes, ($P = 0.001$). Free play outside school, 60(53.3) minutes was significantly ($P = 0.001$) greater

than organised activities outside school, 17(27.2) minutes on school days. Free play on weekend days, 114(101.6) minutes was significantly (P = 0.001) greater that organised activities, 26(65.6) minutes.

On school days the total amount of MVPA achieved through free play from in school and out of school activities, 92(72.3) minutes, was significantly greater (P = 0.001) than that achieved through in school and out of school organised activities 32(30.4).

The total amount of MVPA achieved through out of school activities on a school day 77(57.3) was significantly (P = 0.001) greater than that achieved through school based activities 47(27.7) minutes.

Total MVPA was greater on a weekend day 140(108.2) minutes than on a school day 124(72.8) minutes, but not significantly, P > 0.05.

The contribution made to total daily MVPA was calculated for the different activity categories, for total in school and out of school activity, total clubs and total free play on school days. For weekend days the contribution from clubs and free play was calculated.

Table 8: Proportion of daily MVPA achieved from different categories per school day

Category	Proportion of daily MVPA
School clubs	11.3%
School free	26.6%
Home clubs	13.7%
Home free	48.4%
Total in school	37.9%
Total out of school	62.1%
Total clubs	25.8%
Total free	74.2%

On school days organised activities, both school and home based, contributed 25.8% to total daily MVPA, and free play contributed 74.2%. Total activity in school contributed 37.9% and out of school activity contributed 62.1% to total daily MVPA. The greatest contribution from a single category was from free play out of school at 48.4%.

Free play on weekend days made a greater contribution to total daily MVPA than free play on school days at 81.4%, with organised activities contributing 18.6%.

Summary results following reanalysis after removal of outliers are presented below.

Table 9: Minutes MVPA within each category per school day and weekend day following reanalysis after removal of outliers. Mean (±SD)

Category	School day MVPA	Weekend day MVPA
School clubs	14(17.5)	n/a
School free	27(22.7)	n/a
Home clubs	11(21.3)	9(22.1)
Home free	36(35.4)	67(59.9)
Total in school	40(25.8)	n/a
Total out of school	48(36.9)	n/a
Total clubs	25(26.7)	9(22.1)
Total free	63(50.4)	67(59.9)
Total	88(51.0)	76(59.2)

Analysis of data set 2 also showed that children were achieving significantly ($P < 0.05$) more of their MVPA through free play than through organised activities. This was true for both school based and home based activities on school days and for all activities on weekend days. However, activity levels were shown to decrease at the weekend for data set 2, though not significantly ($P > 0.05$).

Table 10: Proportion of daily MVPA achieved from different categories per school day following reanalysis after removal of outliers.

Category	Proportion of daily MVPA
School clubs	15.9%
School free	30.6%
Home clubs	12.5%
Home free	41.0%
Total in school	45.5%
Total out of school	54.5%
Total clubs	11.8%
Total free	88.2%

Analysis following removal of the outliers revealed similar patterns to that for the original data file. On school days organised activities, both school and home based, contributed 28.4% to total daily MVPA, and free play contributed 71.6%. The greatest contribution from a single category again came from free play out of school at 41.0%. Out of school activities contributed more 54.5% than in school activities 45.5%, although the difference between the two areas was smaller than for the full data set.

Weekend free play again made a greater contribution to total daily MVPA than school day free play, although the difference between free play and organised activities on weekend days was greater with free play contributing 88.2% to total daily MVPA and organised activities contributing 11.8%.

Results from both data sets show that children achieved most of their daily MVPA from free play and from activities which took place out of school.

5.4: Gender differences for achieving recommended levels

Gender differences were determined by cross tabulation and chi square tests. The numbers and proportions of boys and girls achieving the recommended 60 minutes of MVPA were determined for each recording day.

Table 11: Number of children achieving recommended levels of MVPA each day by gender

		Boys	Girls	Total
Monday	Ach	15	24	39
	Not	3	11	14
Tuesday	Ach	15	26	41
	Not	3	9	12
Wednesday	Ach	17	26	43
	Not	1	9	10
Thursday	Ach	16	28	44
	Not	2	7	9
Friday	Ach	15	26	41
	Not	3	9	12
Saturday	Ach	17	24	41
	Not	1	11	12
Sunday	Ach	15	19	34
	Not	3	16	19

The number of boys (n=18) achieving recommended levels of MVPA varied from 15 on three days of the week to 17 on two days. For girls (n=35) the numbers achieving recommended levels varied from 19 on Sunday to 28 on Thursday.

Figure 3 illustrates that on each day of the week the proportion of boys achieving recommended levels of MVPA was greater than the proportion of girls and the difference was greater on weekend days.

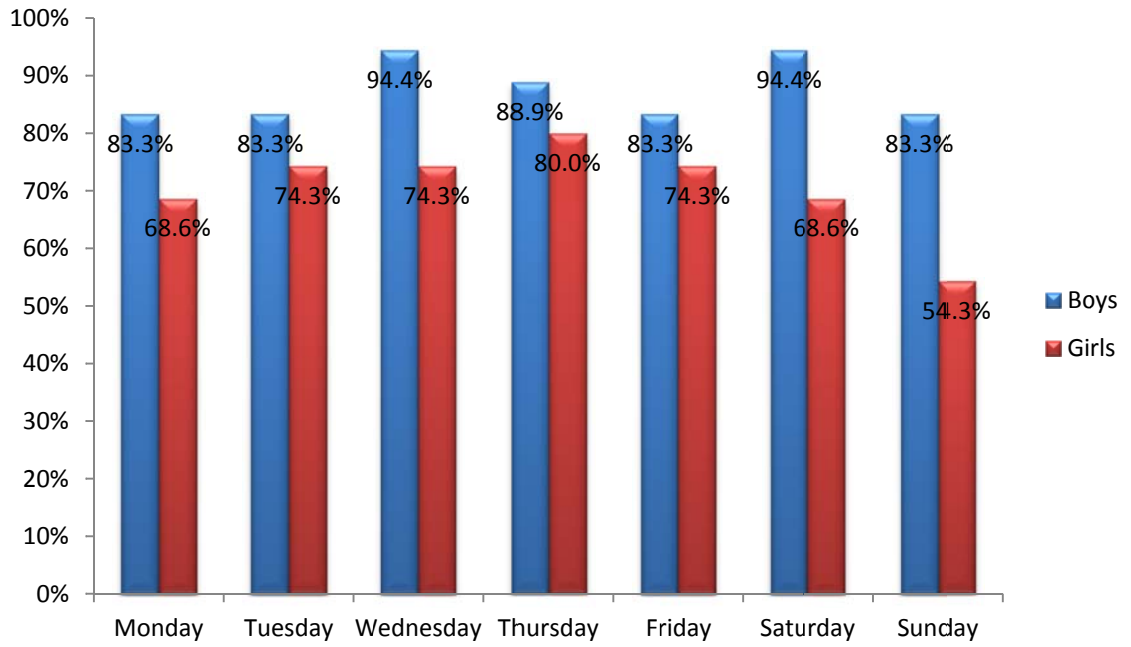

Figure 3: Proportion of boys and girls achieving recommended levels of activity each day

Each day a proportion of boys and girls did not meet recommended levels of MVPA. For boys this ranged from only 5.6% (n=1) of boys not meeting recommended levels on Wednesday and Saturday to 16.7% (n=3) not meeting levels on Monday, Tuesday, Friday and Sunday. The range for girls was greater with 20.0% (n=7) not meeting levels on Thursday to 45.7% (n=16) not meeting levels on Sunday. Proportionally less girls than boys

met these levels on each day of the week with the difference between the genders increasing at the weekend. The differences between the genders on school days were not significant ($P > 0.05$). The proportion of boys achieving recommended levels on both Saturday (94.4%) and Sunday (83.3%) was significantly ($P < 0.05$) greater than the proportion of girls meeting these levels (68.6% and 54.3% respectively).

Gender differences also occurred in the numbers of children who seldom met recommended levels. 34.2% of girls (n=13) and 22.2% of boys (n=4) did not meet this level on three or more days during the week. 5.3%, 2 girls did not achieve this level on any day.

The average proportion of boys and girls achieving recommended levels of MVPA was determined per school day, per weekend day and per day.

Table 12: Proportion achieving recommended MVPA levels per school day, weekend day and per day by gender

	School day		Weekend day		Per day	
	Ach	Not	Ach	Not	Ach	Not
Boys	86.6%	13.4%	88.9%	11.1%	87.8%	12.2%
Girls	74.3%	25.7%	61.5%	38.5%	67.9%	32.1%
Total	78.5%	21.5%	70.8%	29.2%	74.7%	25.3%

More children were shown to be meeting recommended levels of MVPA on school days (78.5%) than on weekend days (74.7%). This was due to the decline in the proportion of girls achieving this level of MVPA from 74.3% on school days to 61.5% on weekend days as the proportion of boys meeting recommended levels MVPA was higher on weekend days

(88.9%) than on school days 86.6%. The proportion of girls achieving recommended levels was lower than the proportion of boys both on school days and on weekend days. Girls = 74.3%, boys = 86.6% on school days. Girls = 61.5%, boys = 88.9% on weekend days.

The proportions achieving recommended levels when the data were reanalysed using 3 blocks of activity to indicate meeting recommended levels and following the removal of outliers are shown below.

Table 13: Proportions meeting recommended levels of MVPA by gender following reanalysis after removal of outliers

Cut off point*	2		3	
Gender	Boys	Girls	Boys	Girls
School day	82.2%	63.6%	68.9%	50.9%
Weekend day	77.8%	43.2%	55.6%	36.4%
Daily	80.0%	53.4%	62.3%	43.7%

*Number of time blocks used to indicate achieving recommended levels

When the data were reanalysed more boys than girls were still shown to be achieving recommended levels of MVPA (2 blocks, boys = 80.0%, girls = 53.4%. 3 block, boys = 62.3%, girls = 43.7%). However, the proportions of boys achieving these levels on weekend days were now shown to be less than on school days (2 blocks, weekend day = 77.8%, school day = 82.2%. 3 blocks, weekend day = 55.6%, school day = 68.9%).

5.5: Gender differences for activity categories

The amount of time spent in each activity category on each recording day was determined separately for boys and girls.

Table 14: Minutes MVPA achieved through organised activities and free play by gender. Mean (±SD)

	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
	B	G	B	G	B	G	B	G	B	G	B	G	B	G
School clubs	18 (25.5)	23 (30.9)	3 (9.7)	14 (33.6)	18 (27.5)	10 (20.5)	3 (9.7)	15 (30.3)	12 (23.3)	18 (27.4)	n/a	n/a	n/a	n/a
School free	38 (26.8)	22 (26.6)	48 (25.5)	22 (25.6)	52 (24.8)	27 (26.6)	48 (29.4)	28 (30.8)	43 (25.7)	28 (30.8)	n/a	n/a	n/a	n/a
Home clubs	8 (24.8)	11 (34.2)	27 (52.4)	24 (49.8)	17 (27.7)	14 (44.5)	5 (21.2)	31 (71.8)	18 (45.0)	13 (35.1)	32 (82.6)	30 (88.8)	15 (50.7)	24 (67.4)
Home free	68 (68.1)	36 (52.9)	53 (51.0)	51 (59.0)	77 (74.4)	66 (76.9)	85 (52.7)	59 (81.5)	68 (58.0)	59 (69.2)	182 (116.6)	107 (102.2)	157 (132.8)	69 (85.3)
Total	133 (84.3)	93 (75.0)	132 (77.1)	111 (81.9)	163 (77.1)	117 (102.5)	142 (68.9)	133 (106.5)	141 (92.5)	118 (92.0)	213 (107.9)	137 (130.4)	172 (127.6)	93 (97.5)

B=boys, G=Girls

Time spent in MVPA from school clubs varied from 10(20.5) minutes on Wednesday to 23(30.9) minutes on Monday for girls. Boys spent from 3(9.7) minutes MVPA from school clubs on Tuesday and Thursday to 18(27.5) minutes on Wednesday. Out of school clubs accounted for between 11(34.2) minutes on Monday to 31(71.8) minutes on Thursday for girls. For boys this varied from 5(21.2) minutes on Thursday to 27(52.4) minutes on Tuesday. For both boys and girls in school free play was less than out of school free play on each day of the week, and MVPA from clubs was less than MVPA from free play on each day. Total MVPA varied from 93(75.0) minutes on Monday to 137(130.4) on Saturday for girls and from 132(77.1) minutes on Tuesday to 213(107.9) minutes on Saturday for boys.

The data were further analysed per school day and per weekend day to determine the significance of the differences between the categories, between the school and weekend days and between in school and out of school activities within the genders, and to determine differences between the genders.

Table 15: Minutes MVPA within each category per school day and weekend day by gender. Mean (±SD)

	School day MVPA		Weekend day MVPA	
Category	Boys	Girls	Boys	Girls
School clubs	11(11.3)	16(17.8)	n/a	n/a
School free	46(20.7)	26(24.6)	n/a	n/a
Home clubs	15(21.4)	19(28.5)	23(61.4)	27(68.5)
Home free	70(48.1)	54(55.6)	169(113.6)	86(83.1)
Total in school	57(23.2)	42(28.6)	n/a	n/a
Total out of school	85(54.3)	73(59.0)	n/a	n/a
Total clubs	26(24.0)	35(33.2)	23(61.4)	27(68.5)
Total free	116(60.0)	80(75.8)	169(113.6)	86(83.1)
Total	142(67.3)	115(74.7)	192(108.7)	113(99.0)

Paired t tests revealed differences between the different categories of activities within the genders. For boys significantly ($P < 0.05$) more time was spent in free play, 46(20.7) minutes than clubs, 11(11.3) for in school activities. Home based free play, 70(48.1) minutes was also significantly ($P < 0.05$) greater than home based organised activities, 15(21.4) minutes on

school days. The total free play, 116(60.0) minutes was significantly ($P < 0.05$) more than the total clubs, 26(24.0) minutes on school days. The total activity out of school, 85(54.3) minutes was significantly ($P < 0.05$) greater than the total activity in school, 57(23.2) minutes. On weekend days free play, 169(113.6) minutes was significantly ($P < 0.05$) more than clubs, 23(61.4) minutes. The total activity on the weekend 192(108.7) minutes was significantly ($P < 0.05$) more than the total activity on a school day 142(67.3) minutes.

For girls more time was spent in free play, 26(24.6) minutes than clubs, 16(17.8) minutes but not significantly ($P > 0.05$) for school activities. Significantly ($P < 0.05$) more time was spent in home based free play, 54(55.6) minutes than home based clubs, 19(28.5) minutes on school days. Total free play, 80(75.8) minutes was also significantly ($P < 0.05$) more than total clubs, 35(33.2) minutes on school days. The total activity out of school, 73(59.0) minutes was significantly ($P < 0.05$) greater than the total activity in school, 42(28.6) minutes. On weekend days free play, 86(83.1) minutes was significantly ($P < 0.05$) more than clubs, 27(68.5) minutes. Total activity on a school day, 115(74.7) minutes was greater than on a weekend day, 113(99.0) minutes but not significantly ($P > 0.05$).

MVPA from free play increased significantly ($P < 0.05$) from 116(60.0) minutes on a school day to 169(113.6) minutes on a weekend day for boys. A much smaller and non significant ($P > 0.05$) increase was found for girls, from 80(75.8) minutes on a school day to 86(83.1) minutes on a weekend day.

Independent t tests revealed gender differences for the different categories of activity. Boys engaged in significantly ($P < 0.05$) more activity than girls in several categories. Although girls spent more time than boys in organised activities the differences were not significant ($P > 0.05$). Boys engaged in significantly ($P < 0.05$) more free time activity in school, 46(20.7) minutes than girls, 26(24.6) minutes. Weekend day free time activity for boys, 169(113.6)

minutes was also significantly ($P < 0.05$) greater than for girls, 86(83.1). Total activity per weekend day was significantly ($P < 0.05$) greater for boys 192(108.7), minutes than girls, 113(99.0) minutes. Other differences between boys and girls for the different categories of activity were not significant ($P > 0.05$).

Table 16: Proportion of daily MVPA for each activity category per school day by gender

Category	Proportion of daily MVPA	
	Boys	Girls
School club	7.7%	13.9%
School free	32.4%	22.6%
Home club	10.6%	16.5%
Home free	49.3%	47.0%
Total in school	40.1%	36.5%
Total out of school	59.9%	63.5%
Total clubs	18.3%	30.4%
Total free	81.7%	69.6%

The contribution to total daily MVPA from the different categories was similar for boys and girls. On school days the largest contribution to total daily MVPA came from free play outside school, 49.3% for boys and 47.0% for girls. Home based activities contributed more (boys = 59.9%, girls = 63.5%) than school based activities (boys = 40.1%, girls = 36.5%).

Free play contributed more (boys = 81.7%, girls = 69.6%) than organised activities (boys = 18.3% girls = 30.4%).

Free play on weekend days made a greater contribution to total daily MVPA, than free play on school days at 88.0% for boys and 76.1% for girls.

The proportions of daily MVPA from the different activity categories for boys and girls following reanalysis after the removal of outliers are shown below.

Table 17: Proportion of daily MVPA for each activity category per school day by gender following reanalysis after the removal of outliers

Category	Proportion of daily MVPA	
	Boys	Girls
School club	9.1%	18.9%
School free	42.7%	22.8%
Home club	13.6%	12.7%
Home free	34.5%	45.6%
Total in school	51.8%	41.8%
Total out of school	48.2%	58.2%
Total clubs	22.7%	31.6%
Total free	77.3%	68.4%

Similar patterns to those for the original data set were found for girls from data set 2. However, for boys free play in school became the category which contributed most at 42.7% and in school activities contributed more (51.8%) than out of school activities (48.2%).

The contributions to MVPA from weekend free play were shown to be even greater for data set 2 at 93.3% for boys and 84.6% for girls.

Chapter 6

Discussion

6: Discussion

6.1: Recommended Activity Levels

Primary Research Question

What proportion of 10-11 year olds are undertaking sufficient MVPA each day during the school week to meet recommended levels of at least 60 minutes MVPA per day?

PA was measured for one full week during the school term. The proportion of 10-11 year olds undertaking sufficient MVPA each day during the school week to meet recommended levels of at least 60 minutes per day ranged between 64.2% on Sunday and 83.0% on Thursday. More children were achieving recommended MVPA on school days (78.5%) than on weekend days (70.8%). This was mainly due to the large decrease in the numbers achieving this level on Sunday. On all other days, for the 53 children included in this analysis, between 73.6% (39 children) and 83.0% (44 children) achieved recommended levels, whereas on Sunday only 64.2% (34 children) met this level. The proportion achieving recommended levels per day throughout the week was 74.7%.

A more detailed analysis of the data revealed that 32.1% (17 children) did not achieve this level on three or more days during the week. Within that group 3.8% (2 children) did not meet recommended activity levels on any day.

Reanalysis using the alternative cut off point of three time blocks to indicate meeting recommended levels of activity showed lower proportions achieving this level. This ranged from 56.6% to 71.7%. The proportion achieving on a school day, at 68.3% was again higher than that on a weekend day, at 62.3%.

Comparisons with other recent studies are difficult as large variations in the proportions of children in this age group meeting recommended amounts of MVPA have been reported. The variations are likely to be due to the methods of measurement and the thresholds used to define MVPA.

Troiano et al., (2007) report substantially higher proportions shown to be achieving PA recommendations from self-report methods than objectively measured activity. Data collected from activity diaries of children aged 5-12 showed 85% were meeting recommended levels (Spinks, Macpherson, Bain and McClure, 2006). Activity levels of the 10-12 year olds were reported to be lower, although the separate figures for this group were not provided.

Objectively measured PA would not be restricted by the time blocks as in the present study. Additionally objective measures are less subject to a reactivity effect and not influenced by participant perceptions. Accelerometers have been used in several studies among this age group. They provide accurate information of total activity not including water based activities or cycling. However, as the cut off point used to define MVPA for this age group ranges from CPM > 1000 to CPM > 3600, large variations have been reported in the proportions meeting recommended guidelines as shown in Table 18. The lower the cut off point used to define MVPA the greater the proportion shown to be achieving recommended levels.

Table 18: Variations in proportions shown to be meeting recommended guidelines for accelerometer measured PA, when different cut off points are used to define MVPA.

Study	Proportion meeting recommendations	Accelerometer cut point used to define MVPA
Leary et al. 2008	2.6%	>3600
Van Sluijus et al. 2008	69%	>2000
Riddoch et al. 2004	97%	>1000

A more precise definition of what constitutes MVPA is required for meaningful conclusions and comparisons to be made.

6.2: Activity Patterns

The possibility of overestimation of activity cannot be ignored due to the very large amounts of time spent in MVPA recorded by some children (maximum 480 minutes). This meant that it was difficult to get accurate data of the precise amount of time spent in MVPA. However, the children were grading their activities and describing the contexts in which the activities took place which enabled the patterns of activity to be determined.

Children were shown to be achieving significantly ($P < 0.05$) more of their MVPA through free play than through organised activities. This was true for both school based and home based activities on school days and for all activities on weekend days. Total out of school activity, 77(57.3) minutes was significantly ($P < 0.05$) greater than total in school activity, 47(27.7) minutes. A small but non-significant ($P > 0.05$) increase in activity at the weekend was found.

School day organised activities, both school and home based, contributed 25.8% to total daily MVPA, and free play contributed 74.2%. Activity achieved through school based organised activities contributed the least to total daily MVPA at 11.3%. Slightly more activity was achieved through home based organised activities, 13.7%. Out of school free play contributed the most, at 48.4% on a school day and school based free play contributed slightly less at 26.6%. The contribution to total daily MVPA from all activities in school, at 37.9% was less than that from total activities out of school, 62.1%.

Free play on weekend days made a greater contribution to total daily MVPA than free play on school days, at 81.4%, with organised activities contributing 18.6%. More time was available at the weekend for children to engage in PA and the results showed that the majority of this time was spent in free play.

Children achieved most of their daily MVPA from free play and from activities which took place out of school.

Reanalysis following the removal of outliers revealed similar patterns of activity with free play and out of school activities contributing most towards children's daily MVPA.

Gidlow, Cochrane, Davey and Smith, (2008) showed similar differences between in school and out of school activity. They reported significantly ($P < 0.001$) higher out of school, mean (±SD) of 571.4 (±197.4) accelerometer CPM than in school activity, mean 510.7 (±148.5) CPM for primary school children. The importance of free play was reported by Brockman, Jago and Fox, (2010) who found that after school free play made a significant ($P < 0.05$) contribution to MVPA for many primary school children.

It should be noted that this study took place during a week of fine, dry weather in June. The long daylight hours and fine weather meant that a considerable amount of time could be spent

outdoors. In bad weather conditions children often remain indoors during school breaks, where space does not allow for active play. Additionally PE lessons may be cancelled for adverse weather conditions and free play after school would be restricted by poor weather and dark evenings. In addition one of the schools was involved in inter school sports on two evenings of the week which might have been expected to produce higher figures for organised school activity. However, only a few (n=10) of the higher sporting ability children were involved in these sports. The present results are therefore likely to be amongst the higher levels of activity for this age group during the year.

6.2.1: School based organised activities

The small contribution made to total MVPA from school PE lessons found in this study is in agreement with the findings of Waring, Warburton and Coy, 2007 and Fairclough and Stratton, 2005.The National Curriculum (NC) programme of study for teaching PE at KS2 places a strong emphasis on the development and application of skills, tactics and compositional ideas. Knowledge and understanding of health and fitness is required, however this is described as gaining an understanding of how activity affects the body in the short term, understanding the need to warm up and wear appropriate clothing, and that activity is good for health. There is no requirement for the children to be engaging in specific levels of activity during the lessons. Recommendations from DCSF and QCDA are for at least 75 minutes of curriculum time per week assigned to deliver the PE programme of study at KS2. The government has set targets for this to be increased to two hours per day by 2011 (PESSYP, 2008). PE lessons generally take place on two sessions during the week. The lack of guidance within the NC for PE together with the infrequency of PE lessons combine such that the amount of time which could be spent in MVPA during PE lessons would not contribute substantially towards achieving recommended daily levels. Additionally, when the

proportion of PE lessons actually spent in MVPA are analysed the findings are more concerning.

Waring, Warburton and Coy (2007) found that 44% of all PE lessons observed lasted for less than 30 minutes. Within the lessons 45.9% of the time was spent statically developing motor skills, 18% of the time was spent in passive activities such as listening, watching and queuing. Only 14% of the time was spent engaging in activity of at least moderate intensity. The authors suggest that the reduction in the training available for primary school teachers in PE together with the increased workload and greater attention and time required for numeracy and literacy over recent years may be contributory factors. Children are assessed and schools may be judged by Standard Assessment Tests (SATs). Indeed, permission was granted to conduct this study in one of the schools only on condition that it took place after the numeracy and literacy SATs.

Fairclough and Stratton, 2005 found that participation in MVPA during PE lessons varied by pupil ability. High ability pupils participate in proportionally more MVPA (38.3%) during PE lessons than those with average (31.0%) or low (33.1%) ability. For PE to make a more significant contribution to children's MVPA guidance needs to be provided to teachers and lessons need to be planned and delivered taking PA into consideration. The differences between ability groups are exacerbated during competitive inter school sports and after school clubs. The clubs are limited in the number of children that can participate. When they are used as preparation for inter school competitions only the higher ability children would be included. Only 16 children (30.2%) in this study were involved in after school organised activities. This may be higher than usual as one school held inter school competitions on two evenings of the week, with ten children involved. For the other school six children attended an after school club on one evening during the week. This study found that organised

activities at school, both PE lessons and after school clubs, contributed only 11.3% to total daily MVPA.

6.2.2: School based free play

Unlike organised school activities free time during school breaks occurs each day and, weather permitting, provides the opportunity for children to engage in unstructured PA. It was found that children spent mean of 33(±25.1) minutes per day in MVPA during free time at school. This accounted for 26.6% of total daily MVPA.

It is only in recent years that investigations into children's activity levels during free time and the contribution of free play towards total daily activity have taken place. The results of the present study are in line with those of other recent studies. Significant contributions to total daily MVPA have been found from PA during school breaks which can be increased further by playground interventions and increased duration of breaks. Playtime was shown to contribute between 5-40% of recommended daily PA levels by Ridgers, Stratton and Fairclough, 2006. The introduction of a simple playtime-based intervention in the form of playground markings resulted in an increase in the amount of time children spent in MVPA of 18 minutes during playtime. An increase in overall activity and MVPA during break has been shown to be related to an increase in the number of permanent play facilities. Each extra play facility resulted in an extra four minutes MVPA during school time (Neilsen, Taylor, Williams & Mann, 2010). Longer break times have been shown to be associated with higher PA participation as the proportion of the break time spent in MVPA is greater for longer breaks. This may be explained by children having more time to become engaged in games and other activities (Ridgers, Stratton, Fairclough & Twisk, 2007).

The schools in this study had few play facilities for the Year 6 children. One school had basketball hoops which were a popular choice of activity. Both schools allowed children to

bring their own footballs for use at break times, and 52.8% of the children regularly engaged in ball games during break.

6.2.3: Home based activities

Children were found to be significantly ($P < 0.05$) more active outside school on a school day, 77(±57.3) minutes MVPA than during school, mean 47(±27.7) minutes MVPA. Out of school activity accounted for 62.1% and in school activity accounted for 37.9% of total daily MVPA. Similar findings were reported by Gidlow, Cochrane, Davey and Smith, (2008). For primary school children mean (±SD) accelerometer CPM in-school was 510.7 (±148.5) compared to 571.4 (±197.4) out-of-school, ($P < 0.001$). In-school activity was shown to account for approximately 30% of children's total weekly MVPA.

Home based organised activities accounted for a small proportion of daily MVPA with 17(±27.2) minutes per school day and 26(±65.6) minutes per weekend day. This was equivalent to 13.7% of total daily MVPA on school days and 18.6% on weekend days. These figures include large variations as few children took part in regular organised activities outside school. 25 children (47.2%) took part in home based organised activities; however the majority (n=16) attended only once or twice in the week for no more than 60 minutes each time. For the others (n=9) organised activities took place on four or more days during the week and the amount of MVPA achieved from such clubs provided a substantial amount towards overall MVPA, accounting for up to 360 minutes of MVPA throughout the week. To the author's knowledge this area of children's activity has not been previously studied.

Home based free play was the category that contributed most towards total daily activity, with a mean of 60(±53.3) minutes on school days and 114(±101.6) minutes on weekend days. This was equivalent to 48.4% of total daily MVPA on school days and 81.4% on weekend days. Active play after school was shown to make a significant ($P < 0.05$) contribution to

MVPA of many 10-11 year old primary school children in the study by Brockman, Jago and Fox, (2010) in what they believe to be the first UK study in this area. They considered active play after school to be between the hours of 3 and 6 pm. The data were collected between February and March when daylight hours were shorter than in the present study which found that many children were active until much later in the evenings. As previously described, this study took place in June, when daylight hours were at their longest and the weather was fine each day. Additionally, homework was not being set at this time of year as SATs had been completed and there was a winding down of academic work towards the end of term and the end of the children's time at primary school. Consequently the time available for engaging in physical activities after school was at a maximum.

6.2.4: Comparing school days with weekend days

Activity levels were found to be greater on weekend days, mean of 140(±108.2) minutes MVPA than on school days, mean of 124(±72.8) minutes but not significantly ($P > 0.05$). An increase in free play and a decrease in organised activities at the weekend were found. (Free play, school day = 92(±72.3) minutes, weekend day = 114(±101.6) minutes, organised activities, school day = 32(±30.4) minutes, weekend day = 26(±65.6) minutes).More time was available at the weekend for children to engage in PA and the results showed that the majority of this time was spent in free play.

Reanalysis following removal of outliers again showed an increase in free play and a decrease in organised activities at the weekend, however total activity was found to be lower on weekend days, mean of 76(±59.2) minutes than on school days, mean of 88(±51.0) minutes but not significantly ($P > 0.05$).

Previous studies report conflicting results when comparing school day activity with weekend activity. Decreases in MVPA levels at weekends were reported by Nader, Bradley, Houts,

McRitchie and O'Brien, (2008), with the difference between weekday and weekend activity increasing with age. In contrast Gidlow, Cochrane, Davey and Smith, (2008) found higher levels of activity at weekends than on school days for primary school children. However these results were for children across the whole of the primary school age range and secondary school children were shown to be engaging in less activity at the weekends. Results for children in their final year of primary school would be required to make direct comparisons with the present study.

6.3: Gender Differences

Differences in the PA levels and patterns of boys and girls have been well documented in recent years. (Riddoch et al., 2004, Jago, Anderson, Baranowski & Watson, 2005, Neilsen, Taylor, Williams & Mann, 2010, McKenzie, Crespo, Baquero & Elder, 2010, Brockman, Jago & Fox, 2010). Boys have been shown to engage in higher levels of MVPA than girls. Additionally gender differences increase with age and the decline in PA as children enter adolescence is reported to be greater among girls.

Similar differences were found in this study with 87.8% of boys and 67.9% of girls achieving recommended levels of MVPA per day. Total activity per day was significantly ($P < 0.05$) greater for boys, 167(±81.2) minutes, than girls, 114(±77.6) minutes.

This study has investigated those differences further. When activity on school days and weekend days were analysed separately it was found that boys' activity increased on weekends, from 86.6% to 88.9% achieving recommended levels, whereas for girls those achieving recommended levels decreased from 74.3% on school days to 61.5% on weekend days. The substantial decrease in activity levels amongst girls had masked the boys' increased

activity at weekends when the data were analysed for the group as a whole. Activity levels for the whole group were shown to decrease from 78.5% achieving recommended levels on school days to 70.8% on weekend days. Total MVPA per weekend day was also shown to be significantly ($P < 0.05$) greater for boys, 192(±108.7) minutes than girls, 113(±99.0) minutes.

The contexts in which boys and girls achieved their activity were also investigated. For both boys and girls the largest contribution to total MVPA came from free play outside school, and the least from clubs within school. Boys were found to engage in significantly ($P < 0.05$) more free time activity than girls on both school days and weekend days. On school days girls engaged in 80(±75.8) minutes MVPA during free play whereas boys engaged in 116(±60.0) minutes. The differences were even greater on weekend days with boys spending 169(±113.6) minutes in free play MVPA, and girls only 86(±83.1) minutes.

The contribution to total daily MVPA from the different categories was similar for boys and girls. The largest contribution came from free play outside school, 49.3% for boys and 47.0% for girls. Home based activities contributed more (boys = 59.9%, girls = 63.5%) than school based activities (boys = 40.1%, girls = 36.5%). Free play contributed more (boys = 81.7%, girls = 69.6%) than organised activities (boys = 18.3% girls = 30.4%).

Free play on weekend days made a greater contribution to total daily MVPA, than school day free play at 88.0% for boys and 76.1% for girls.

6.4: Additional findings

This study did not set out to assess the precise activities taking place, however some interesting results were observed. The most common out of school activity was described as “playing out”, which was often defined further and playing football accounted for the

majority of the free time MVPA for many children (n=21). The fact that the study took place at the same time as the football world cup may have had an influence. The use of garden trampolines was also frequently recorded (n=9) and their use was intermittent throughout the day, indicating that they are a useful facility for children to use for short bouts of activity. Although home based clubs provided little PA in the sample as a whole, for several it accounted for a substantial amount of their overall MVPA. Dance classes provided substantial amounts of MVPA for some (n=5) who attended three times during the week, for up to three hours each time plus additional time was spent practising dance during free time. Additionally as many organised activities took place indoors they would not be as subject to seasonal differences as the outdoor activities, and their contribution to total daily activity may be greater during the winter months.

6.5: Strengths and limitations

The main strength of this study is in the assessment of the contexts in which the activities took place. The context of all MVPA throughout the week was recorded thus enabling patterns of activity to be determined together with the relative contributions to total activity from the different areas. This study has further strengths in that activities were recorded for the entire waking day for a full week which enabled differences by day to be determined. Important differences, particularly for organised activities, between different school days or between Saturdays and Sundays would otherwise have been missed. It also made it possible to determine the number of individuals who seldom or never achieved recommended MVPA levels.

This study is limited by the measurement characteristics of the activity diary, in that the children were required to record a main activity for each 30 minute block. This may have

resulted in the omission of intermittent activities or the overestimation of activities. Although most of the children completed the diaries correctly, the responses of some showed that there had been a degree of misunderstanding regarding the correct method of completion, which led to overestimation of activity. However, this was addressed by reanalysis of the data once outliers were removed. This study is also limited by the sample size, (n = 53) particularly for boys (n = 18). Unfortunately the proportion of boys willing to take part in the study was very low.

6.6: Recommendations

6.6.1: Future research

Future research would benefit from combining objectively measured PA with the activity diaries. This would reduce the subjectivity of self report and the uncertainty due to possible under or overestimation of activities.

As the study took place at a time of year when activity levels were likely to be at their highest, repeating at different times of year would highlight seasonal differences. Repeating the study at different times during the school year would also provide information on PA in relation to the volume of school work. Although gaining permission to undertake a study prior to school examinations may prove difficult.

The study took place at a point in children's development when activity levels have been shown to begin to decrease. Longitudinal studies, following a cohort through subsequent years would determine changes due to ageing.

The majority of MVPA was found to take place during free play. A more detailed investigation into the types of activities engaged in and the areas where these took place

could highlight possible areas for focus when initiatives to increase PA among children are being developed.

Children's attitudes towards PA could also be assessed, which may clarify the reasons for the variations found between activity levels of different children.

6.6.2: Enabling Physical Activity

Opportunities for increasing PA during the school day could be provided if more curriculum time was made available for PE lessons. Studies have shown that increasing PE time does not have a detrimental effect on school performance (Ahamed et al., 2007, Trudeau & Shepard, 2008). Additionally PE lessons need to be planned to include more PA with less time spent in passive activities. This could be achieved through the use of specialist teachers or, as one of the schools in this study did, utilising the skills of outside sports coaches. After school clubs could cater for the less able in terms of sporting ability by incorporating more play based activities which are not reliant on sporting skills. Increasing the number of play facilities and the length of the break times would enable more active free play during the school day. Consideration needs to be given to issues concerning safety and supervision when play facilities are provided at school, however even simple measures such as allocating particular areas to different groups of children and the introduction of playground markings have been shown to be effective in increasing school free time activity, (Loucaides, Jago & Charalambous, 2009).

Safety concerns have been reported to be the main restricting factor for children's PA outside school, (Jago et al., 2009). Active play equipment in gardens and taking part in activities as a family would overcome these concerns.

6.7: Conclusion

Many 10 -11 year old children are not meeting recommended activity levels to benefit health during the school week. The results as to the precise numbers achieving these levels need to be treated with caution due to errors inherent in using self report measures. Given that overestimation of activity is a major problem of self report methods, the actual proportions achieving recommended levels daily may be even lower than those found in this study. In addition and of even greater cause for concern, some children rarely, and a few never achieved these levels. Objective measures of PA are also not without problems, due to uncertainty over cut off points used to define MVPA. A more precise definition of what constitutes MVPA is required for meaningful conclusions to be made.

Activity levels differed by day, gender and context. Boys were more active than girls on school days and weekend days with the difference being greater at weekends. Boys were more active on weekend days and girls more active on school days. All children were more active outside school than in school. To increase the opportunities for children to be active within school improvements need to be made to both curricular PE, to address the PA content of PE lessons, and to the areas and facilities available for use during breaks.

Children achieved most of their MVPA from free play rather than from organised activities both in and out of school. Current initiatives for increasing PA in children mainly focus on organised activities and sports. Future initiatives which focus on improving the time, space and facilities available to children to enable them to participate in safe free play may be more effective in increasing health enhancing PA.

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Appendices

Appendix A

Permission from Schools

The Marlborough Primary School
Tytherington Drive
Tytherington
Maclesfield
SK10 2HJ

Tel: 01625 383050
Fax: 10625 612918

Hi Maria,

I have spoken to Rob Dyson, who runs the parallel class in Year 6. He agrees with me, that the study can go ahead with both classes.

Year 6 PW - 34 children
Year 6 RD - 33 children

We understand that the work will commence once the annual SAT tests have completed. We are both more than happy to cooperate with your work. Please do not hesitate to contact me to arrange further details when necessary.

yours

Philip Whiston
Deputy Headteacher

St. Matthew’s Catholic Primary School
Queens Drive
Walton
Liverpool
L4 8UA

Tel: 0151 226 1871

Dear Maria,

Thank you for your request for our pupils to take part in your research on Physical Activity Levels.

I am more than happy for St. Matthew's pupils to participate and look forward to hearing from you soon, so that we can make all the necessary arrangements.

Regards
Veronica McDonnell
(Headteacher)

Appendix B

Letter of Invitation

Dear Parents and Guardians,

I am a primary school teacher and currently studying for an MSc in Exercise and Nutrition Science. For my dissertation I aim to investigate the physical activity patterns of children in Year 6 at primary school. I would like to ask your permission for your child in Year 6 at St. Matthew's to take part in this study.

Those taking part in the study will be asked to complete an activity diary each day for one week during the school term. Mrs McDonnell has kindly agreed to allow some time during the school day for the children to complete the diaries.

Further information is enclosed on the Participant Information Sheet which includes contact details should you have any questions.

If you and your child decide that they would like to take part please complete the consent form enclosed and return it to me via the school before Friday 11June.

Thank you for your interest.

Maria Robson

Appendix C

Participant Information Sheet

University of Chester

Participant Information Sheet

Physical Activity Patterns of 10-11 year olds during the school week

Your child is being invited to take part in a research study. Before you decide, it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask me if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish your child to take part.

Thank you for reading this.

What is the purpose of the study?

Physical activity is essential to maintain health and to reduce the risk of development of several chronic diseases.
The aim of the study is to find out about the types of and amount of physical activity undertaken by 10 and 11 year olds (Year 6 pupils) during the school week. It further aims to compare activities in and out of school and to compare organised activities with free play.

Why has my child been chosen?

Your child has been chosen as they are currently in Year 6 at primary school.

Does my child have to take part?

It is up to you and your child to decide whether or not to take part. If you decide to take part you will be given this information sheet to keep and be asked to sign a consent form. If you decide to take part you are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect you in any way.

What will happen to my child if they take part?

Your child will be asked to complete an activity diary each day for one week during the school term. The diary will contain information as to the types of activities undertaken both school based and out of school as well as whether they are part of an organised group or free play. No-one will be identifiable in the final report.

What are the possible disadvantages and risks of taking part?

There are no disadvantages or risks foreseen in taking part in the study.

What are the possible benefits of taking part?

By taking part, your child may gain an increased awareness of their personal level of physical activity.

What if something goes wrong?

If you wish to complain or have any concerns about any aspect of the way you have been approached or treated during the course of this study, please contact Professor Sarah Andrew, Dean of the School of Applied and Health Sciences, University of Chester, Parkgate Road, Chester, CH1 4BJ, 01244 513055.

Will my child's taking part in the study be kept confidential?

All information which is collected about your child during the course of the research will be kept strictly confidential so that only the researcher carrying out the research will have access to such information. Only age and gender will be associated with the activity diaries. No-one will be identifiable in the final report.

What will happen to the results of the research study?

The results will be written up into a dissertation for the final project of my MSc. Individuals who participate will not be identified in any report or publication.

Who is organising and funding the research?

The researcher and Centre for Exercise & Nutrition Science.

Who may I contact for further information?

If you would like more information about the research before you decide whether or not you would be willing to take part, please contact:

Maria Robson @chester.ac.uk.

Thank you for your interest in this research.

Appendix D

Participant Consent Form

Title of Project: Physical Activity patterns of 10-11 year olds during the school week

Name of Researcher: Maria Robson

Please initial box

1. I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions. ☐
2. I understand that my child's participation is voluntary and that I am free to withdraw at any time, without giving any reason and without my legal rights being affected. ☐
3. I agree to my child taking part in the above study. ☐

Name of Parent	Date	Signature
Name of Participant	Date	Signature
Researcher	Date	Signature

Appendix E

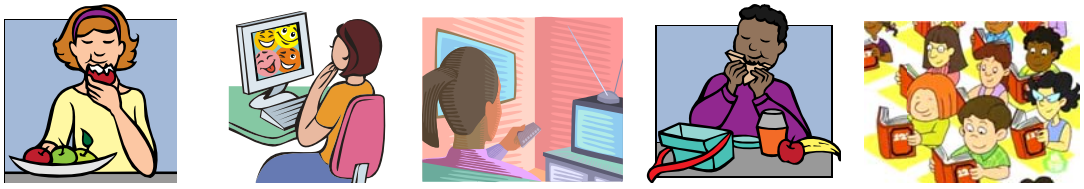
Activity Diary

Activity Diary

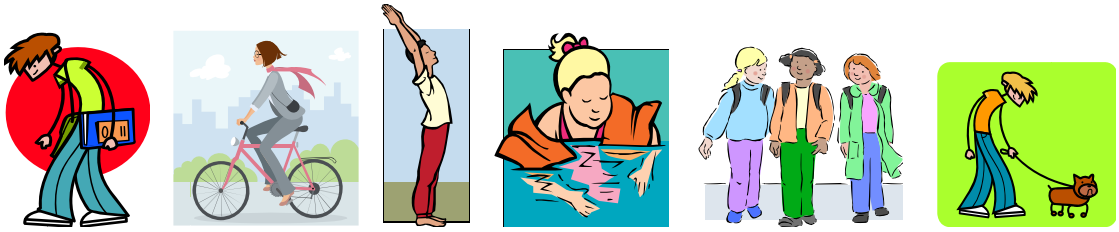
Look at the example of the completed time sheet and follow these instructions to correctly complete the activity diaries.

1. For each time period think about the MAIN activity you did. Write the activity number or name in the appropriate box.
2. Then rate how physically hard these activities were. Place a tick in the appropriate box to indicate if the activities were very light, light, moderate or vigorous.
3. Finally, for each time period, indicate whether the activity was part of a school club or lesson, a club organised from home or free play.

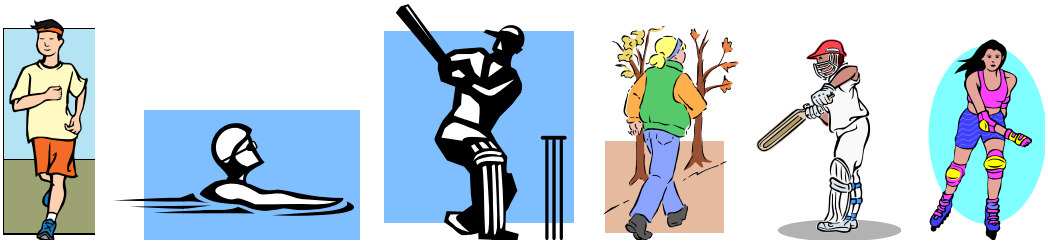
Very Light – Slow breathing, little or no movement



Light – Normal breathing, regular movement



Moderate – Increased breathing, moving quickly for short periods of time



Vigorous – Hard breathing, moving very quickly for longer periods of time

Examples of Activities

1. Eating
2. Sleeping
3. Resting
4. Showering/bathing
5. Riding in a car
6. Travel by walking
7. Travel by cycling
8. Schoolwork
9. Homework
10. Watch TV
11. Reading
12. Using the computer
13. Playing video game
14. Playing on Wii fit
15. Walking
16. Jogging
17. Running
18. Dancing
19. Swimming
20. Riding bicycle
21. Using skateboard
22. Playing football
23. Playing tennis
24. Playing cricket
25. Playing netball

This is just an example list.

You might not do many of the activities listed above.

There will be other activities which you do that are not listed. Write the name of these activities in the appropriate boxes on the activity diary.

The table below shows a sample of a correctly completed time sheet

Note that for each activity only one level is ticked

	Time period	Activity number or name	 Very Light	 Light	 Moderate	 Vigorous	**Sch home free**
Before school	7:00-7:30	2	✓				
	7:30-8:00	1	✓				
	8:00-8:30	4	✓				
	8:30-9:00	5	✓				
During school	9:00-9:30	8	✓				
	9:30-10.00	8	✓				
	10:00-10:30	8	✓				
Break	10:30-11:00	walking round		✓			free
	11:00-11:30	8	✓				
	11:30-12:00	8	✓				
	12:00-12:30	8	✓				
	12:30-1:00	Play chase			✓		free
Lunch	1:00-1:30	1	✓				
	1:30-2:00	8	✓				
	2:00-2:30	22			✓		sch
PE	2:30-3:00	22				✓	sch
	3:00-3:30	8	✓				
	3:30-4:00	Cross country club			✓		sch
	4:00-4:30	Cross country club				✓	sch
After school	4:30-5:00	5	✓				
	5:00-5:30	9	✓				
	5:30-6:00	14			✓		
	6:00-6:30	1	✓				
	6:30-7:00	9	✓				
	7:00-7:30	19 swim club				✓	home
Evening	7:30-8:00	12	✓				
	8:00-8:30	10	✓				
	8:30-9:00	4	✓				
	9:00-9:30	2	✓				
	9:30-10:00	2	✓				

MONDAY

Put a tick to rate how hard these activities were

School club, home club or free play

	Time period	Activity number or name	 Very Light	 Light	 Moderate	 Vigorous	**Sch home Free**
Before school	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
During school	9:00-9:30						
	9:30-10.00						
	10:00-10:30						
Break	10:30-11:00						
	11:00-11:30						
	11:30-12:00						
	12:00-12:30						
Lunch	12:30-1:00						
	1:00-1:30						
	1:30-2:00						
PE	2:00-2:30						
	2:30-3:00						
	3:00-3:30						
After school	3:30-4:00						
	4:00-4:30						
	4:30-5:00						
	5:00-5:30						
	5:30-6:00						
Evening	6:00-6:30						
	6:30-7:00						
	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
	9:00-9:30						
	9:30-10:00						

TUESDAY

Put a tick to rate how hard these activities were

School club, home club or free play

	Time period	Activity number or name	 Very Light	 Light	 Moderate	 Vigorous	**Sch home Free**
Before school	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
During school	9:00-9:30						
	9:30-10.00						
	10:00-10:30						
Break	10:30-11:00						
	11:00-11:30						
	11:30-12:00						
	12:00-12:30						
Lunch	12:30-1:00						
	1:00-1:30						
	1:30-2:00						
PE	2:00-2:30						
	2:30-3:00						
	3:00-3:30						
After school	3:30-4:00						
	4:00-4:30						
	4:30-5:00						
	5:00-5:30						
	5:30-6:00						
Evening	6:00-6:30						
	6:30-7:00						
	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
	9:00-9:30						
	9:30-10:00						

WEDNESDAY

Put a tick to rate how hard these activities were

School club, home club or free play

	Time period	Activity number or name	 Very Light	 Light	 Moderate	 Vigorous	**Sch home Free**
Before school	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
During school	9:00-9:30						
	9:30-10.00						
	10:00-10:30						
Break	10:30-11:00						
	11:00-11:30						
	11:30-12:00						
	12:00-12:30						
Lunch	12:30-1:00						
	1:00-1:30						
	1:30-2:00						
PE	2:00-2:30						
	2:30-3:00						
	3:00-3:30						
After school	3:30-4:00						
	4:00-4:30						
	4:30-5:00						
	5:00-5:30						
	5:30-6:00						
Evening	6:00-6:30						
	6:30-7:00						
	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
	9:00-9:30						
	9:30-10:00						

THURSDAY

Put a tick to rate how hard these activities were

School club, home club or free play

	Time period	Activity number or name	 Very Light	 Light	 Moderate	 Vigorous	**Sch home Free**
Before school	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
During school	9:00-9:30						
	9:30-10.00						
	10:00-10:30						
Break	10:30-11:00						
	11:00-11:30						
	11:30-12:00						
	12:00-12:30						
Lunch	12:30-1:00						
	1:00-1:30						
	1:30-2:00						
PE	2:00-2:30						
	2:30-3:00						
	3:00-3:30						
After school	3:30-4:00						
	4:00-4:30						
	4:30-5:00						
	5:00-5:30						
	5:30-6:00						
Evening	6:00-6:30						
	6:30-7:00						
	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
	9:00-9:30						
	9:30-10:00						

FRIDAY

Put a tick to rate how hard these activities were

School club, home club or free play

	Time period	Activity number or name	 Very Light	 Light	 Moderate	 Vigorous	**Sch home Free**
Before school	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
During school	9:00-9:30						
	9:30-10.00						
	10:00-10:30						
Break	10:30-11:00						
	11:00-11:30						
	11:30-12:00						
	12:00-12:30						
Lunch	12:30-1:00						
	1:00-1:30						
	1:30-2:00						
PE	2:00-2:30						
	2:30-3:00						
	3:00-3:30						
After school	3:30-4:00						
	4:00-4:30						
	4:30-5:00						
	5:00-5:30						
	5:30-6:00						
Evening	6:00-6:30						
	6:30-7:00						
	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
	9:00-9:30						
	9:30-10:00						

SATURDAY

Put a tick to rate how hard these activities were

School club, home club or free play

	Time period	Activity number or name	 Very Light	 Light	 Moderate	 Vigorous	**Sch home Free**
Early morning	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
Morning	9:00-9:30						
	9:30-10.00						
	10:00-10:30						
	10:30-11:00						
	11:00-11:30						
	11:30-12:00						
	12:00-12:30						
Lunch	12:30-1:00						
	1:00-1:30						
After-noon	1:30-2:00						
	2:00-2:30						
	2:30-3:00						
	3:00-3:30						
	3:30-4:00						
	4:00-4:30						
	4:30-5:00						
	5:00-5:30						
	5:30-6:00						
Evening	6:00-6:30						
	6:30-7:00						
	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
	9:00-9:30						
	9:30-10:00						

SUNDAY

Put a tick to rate how hard these activities were

School club, home club or free play

	Time period	Activity number or name	 Very Light	 Light	 Moderate	 Vigorous	**Sch home Free**
Early morning	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
Morning	9:00-9:30						
	9:30-10.00						
	10:00-10:30						
	10:30-11:00						
	11:00-11:30						
	11:30-12:00						
	12:00-12:30						
Lunch	12:30-1:00						
	1:00-1:30						
After-noon	1:30-2:00						
	2:00-2:30						
	2:30-3:00						
	3:00-3:30						
	3:30-4:00						
	4:00-4:30						
	4:30-5:00						
	5:00-5:30						
	5:30-6:00						
Evening	6:00-6:30						
	6:30-7:00						
	7:00-7:30						
	7:30-8:00						
	8:00-8:30						
	8:30-9:00						
	9:00-9:30						
	9:30-10:00						

School Name: _____

Age: _____

Boy or Girl: _____

Appendix F

Instructions for Completing Activity Diary

Instructions for Completing the Activity Diary

Introduce the diaries as a method of recording physical activities over the coming week.

They will include:

- what the activity is
- how physically hard the activity is
- how long the activity lasted
- where activity took place

Hand out the diaries
Instruct children to write their names on the stickers and complete the details on the last page. Name stickers will be removed on collection of the diaries and numbers added for coded identification to preserve anonymity.

Page 1

Explain the different levels with examples.

- Very light – hardly moving
    - watching TV, reading, eating etc
- Light – breathing normally, regular movement
    - Walking, cycling, stretching etc
- Moderate or medium – increased breathing and heart rate
    - Jogging, swimming, playing cricket etc
- Vigorous or hard – get tired very quickly
    - Sprinting, playing sports, fast cycling etc

Give examples of the same activity being at different levels

- Walking can be light or moderate
- Swimming can light, moderate or vigorous
- Cycling can be light, moderate or vigorous
- Playing sport can be moderate or vigorous

Explain how different positions in the same sport can be different levels

- Eg. Cricket, fielding may be waiting a lot of time, but batting or bowling may be very active.

Ask children for examples of activities they take part in and discuss how these would be entered into the activity diary focusing on the level, the time taken and the place.

Pages 2 & 3

Ask the children to work in pairs looking at the numbered list of activities and the sample completed activity sheet.

Work through the example pointing out

- Activities in the numbered list
- Activities not in the list need naming
- Different activity levels
- Different activity areas

Point out that break, lunch, PE etc may not be the exact time.

Repeat the main points

- **Main activity in each half hour**
- **What the activity is**
- **How hard it is**
- **Where it is**

Work through the activity sheet for Monday with the class.
Throughout, encourage questions from children and teachers to ensure understanding.

Provide poster sized instructions and example sheets for display in the classroom.

Provide contact details.

Check with the schools during the week for any problems which may occur.

Appendix G

SPSS Output

Cross tabulation - Numbers and percentages achieving 60 minutes MVPA each day

Table 1: Monday

Crosstab

			Mon achieved or not		
			Not achieved	Achieved	Total
Gender	boy	Count	3	15	18
		% within Gender	16.7%	83.3%	100.0%
		% within Mon achieved or not	21.4%	38.5%	34.0%
		% of Total	5.7%	28.3%	34.0%
	girl	Count	11	24	35
		% within Gender	31.4%	68.6%	100.0%
		% within Mon achieved or not	78.6%	61.5%	66.0%
		% of Total	20.8%	45.3%	66.0%
Total		Count	14	39	53
		% within Gender	26.4%	73.6%	100.0%
		% within Mon achieved or not	100.0%	100.0%	100.0%
		% of Total	26.4%	73.6%	100.0%

Table 2: Tuesday

Crosstab

			Tues achieved or not		
			Not achieved	Achieved	Total
Gender	boy	Count	3	15	18
		% within Gender	16.7%	83.3%	100.0%
		% within Tues achieved or not	25.0%	36.6%	34.0%
		% of Total	5.7%	28.3%	34.0%
	girl	Count	9	26	35
		% within Gender	25.7%	74.3%	100.0%
		% within Tues achieved or not	75.0%	63.4%	66.0%
		% of Total	17.0%	49.1%	66.0%
Total		Count	12	41	53
		% within Gender	22.6%	77.4%	100.0%
		% within Tues achieved or not	100.0%	100.0%	100.0%
		% of Total	22.6%	77.4%	100.0%

Table 3: Wednesday

Crosstab

			Wed achieved or not		
			Not achieved	Achieved	Total
Gender	boy	Count	1	17	18
		% within Gender	5.6%	94.4%	100.0%
		% within Wed achieved or not	10.0%	39.5%	34.0%
		% of Total	1.9%	32.1%	34.0%
	girl	Count	9	26	35
		% within Gender	25.7%	74.3%	100.0%
		% within Wed achieved or not	90.0%	60.5%	66.0%
		% of Total	17.0%	49.1%	66.0%
Total		Count	10	43	53
		% within Gender	18.9%	81.1%	100.0%
		% within Wed achieved or not	100.0%	100.0%	100.0%
		% of Total	18.9%	81.1%	100.0%

Table 4: Thursday

Crosstab

			Thurs achieved or not		
			Not achieved	Achieved	Total
Gender	boy	Count	2	16	18
		% within Gender	11.1%	88.9%	100.0%
		% within Thurs achieved or not	22.2%	36.4%	34.0%
		% of Total	3.8%	30.2%	34.0%
	girl	Count	7	28	35
		% within Gender	20.0%	80.0%	100.0%
		% within Thurs achieved or not	77.8%	63.6%	66.0%
		% of Total	13.2%	52.8%	66.0%
Total		Count	9	44	53
		% within Gender	17.0%	83.0%	100.0%
		% within Thurs achieved or not	100.0%	100.0%	100.0%
		% of Total	17.0%	83.0%	100.0%

Table 5: Friday

Crosstab

			Fri achieved or not		
			Not achieved	Achieved	Total
Gender	boy	Count	3	15	18
		% within Gender	16.7%	83.3%	100.0%
		% within Fri achieved or not	25.0%	36.6%	34.0%
		% of Total	5.7%	28.3%	34.0%
	girl	Count	9	26	35
		% within Gender	25.7%	74.3%	100.0%
		% within Fri achieved or not	75.0%	63.4%	66.0%
		% of Total	17.0%	49.1%	66.0%
Total		Count	12	41	53
		% within Gender	22.6%	77.4%	100.0%
		% within Fri achieved or not	100.0%	100.0%	100.0%
		% of Total	22.6%	77.4%	100.0%

Table 6: Saturday

Crosstab

			Sat achieved or not		
			Not achieved	Achieved	Total
Gender	boy	Count	1	17	18
		% within Gender	5.6%	94.4%	100.0%
		% within Sat achieved or not	8.3%	41.5%	34.0%
		% of Total	1.9%	32.1%	34.0%
	girl	Count	11	24	35
		% within Gender	31.4%	68.6%	100.0%
		% within Sat achieved or not	91.7%	58.5%	66.0%
		% of Total	20.8%	45.3%	66.0%
Total		Count	12	41	53
		% within Gender	22.6%	77.4%	100.0%
		% within Sat achieved or not	100.0%	100.0%	100.0%
		% of Total	22.6%	77.4%	100.0%

Table 7: Sunday

Crosstab

			Sun achieved or not		
			Not achieved	Achieved	Total
Gender	boy	Count	3	15	18
		% within Gender	16.7%	83.3%	100.0%
		% within Sun achieved or not	15.8%	44.1%	34.0%
		% of Total	5.7%	28.3%	34.0%
	girl	Count	16	19	35
		% within Gender	45.7%	54.3%	100.0%
		% within Sun achieved or not	84.2%	55.9%	66.0%
		% of Total	30.2%	35.8%	66.0%
Total		Count	19	34	53
		% within Gender	35.8%	64.2%	100.0%
		% within Sun achieved or not	100.0%	100.0%	100.0%
		% of Total	35.8%	64.2%	100.0%

Tests for normality

Table 8: Tests for normality minutes MVPA within categories per school day and weekend day

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
school club per day	.255	53	.000	.820	53	.000
school free per day	.135	53	.018	.927	53	.003
weekday clubs per day	.193	53	.000	.878	53	.000
weekday free per day	.116	53	.071	.934	53	.006
weekend clubs per day	.426	53	.000	.456	53	.000
weekend free per day	.159	53	.002	.908	53	.001
home clubs on school days	.293	53	.000	.716	53	.000
home free on school days	.190	53	.000	.897	53	.000
total activity per school day	.093	53	.200*	.970	53	.200
total activity per weekend day	.140	53	.012	.935	53	.006

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Table 9: Paired t tests for significant differences between categories

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	school club per day - school free per day	-18.340	31.671	4.350	-27.069	-9.610	-4.216	52	.000
Pair 2	weekday clubs per day - weekday free per day	-60.679	83.791	11.510	-83.775	-37.584	-5.272	52	.000
Pair 3	weekend clubs per day - weekend free per day	-88.585	132.420	18.189	-125.084	-52.086	-4.870	52	.000
Pair 4	home clubs on school days - home free on school days	-42.340	61.408	8.435	-59.266	-25.414	-5.020	52	.000
Pair 5	totalschoolperday - totalhomeperschoolday	-30.113	52.801	7.253	-44.667	-15.560	-4.152	52	.000
Pair 6	school free per day - weekend free per day	-22.075	78.749	10.817	-43.781	-.370	-2.041	52	.046
Pair 7	total activity per school day - total activity per weekend day	-16.245	83.681	11.494	-39.311	6.820	-1.413	52	.164

Chi-square for gender differences on numbers achieving 60 minutes MVPA each day

Table 10: Monday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.333[b]	1	.248		
Continuity Correction[a]	.681	1	.409		
Likelihood Ratio	1.405	1	.236		
Fisher's Exact Test				.333	.207
Linear-by-Linear Association	1.307	1	.253		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4. 75.

Table 11: Tuesday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.556[b]	1	.456		
Continuity Correction[a]	.159	1	.690		
Likelihood Ratio	.577	1	.448		
Fisher's Exact Test				.730	.353
Linear-by-Linear Association	.545	1	.460		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4. 08.

Table 12: Wednesday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.156[b]	1	.076		
Continuity Correction[a]	1.976	1	.160		
Likelihood Ratio	3.709	1	.054		
Fisher's Exact Test				.137	.075
Linear-by-Linear Association	3.096	1	.078		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 3. 40.

Table 13: Thursday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.666[b]	1	.414		
Continuity Correction[a]	.185	1	.667		
Likelihood Ratio	.706	1	.401		
Fisher's Exact Test				.701	.344
Linear-by-Linear Association	.654	1	.419		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 3. 06.

Table 14: Friday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.556[b]	1	.456		
Continuity Correction[a]	.159	1	.690		
Likelihood Ratio	.577	1	.448		
Fisher's Exact Test				.730	.353
Linear-by-Linear Association	.545	1	.460		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4. 08.

Table 15: Saturday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.543[b]	1	.033		
Continuity Correction[a]	3.186	1	.074		
Likelihood Ratio	5.402	1	.020		
Fisher's Exact Test				.041	.031
Linear-by-Linear Association	4.457	1	.035		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4. 08.

Table 16: Sunday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.361[b]	1	.037		
Continuity Correction[a]	3.190	1	.074		
Likelihood Ratio	4.687	1	.030		
Fisher's Exact Test				.068	.034
Linear-by-Linear Association	4.279	1	.039		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6. 45.

Tests for normality minutes MVPA for categories per school day and weekend day by gender

Table 17: Boys

Tests of Normality[b]

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
school club per day	.243	18	.006	.841	18	.006
school free per day	.151	18	.200*	.938	18	.269
weekday clubs per day	.220	18	.021	.896	18	.048
weekday free per day	.170	18	.183	.960	18	.607
weekend clubs per day	.426	18	.000	.452	18	.000
weekend free per day	.085	18	.200*	.972	18	.831
home clubs on school days	.258	18	.003	.747	18	.000
home free on school days	.179	18	.133	.933	18	.219
total activity per school day	.148	18	.200*	.932	18	.211
total activity per weekend day	.091	18	.200*	.971	18	.817
totalschoolperday	.151	18	.200*	.943	18	.328
totalhomeperschoolday	.144	18	.200*	.946	18	.371
total free per school day	.170	18	.183	.960	18	.607
total free per weekend day	.085	18	.200*	.972	18	.831

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

b. Gender = boy

Table 18: Girls

Tests of Normality[b]

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
school club per day	.245	35	.000	.826	35	.000
school free per day	.166	35	.016	.892	35	.002
weekday clubs per day	.179	35	.006	.867	35	.001
weekday free per day	.146	35	.056	.880	35	.001
weekend clubs per day	.425	35	.000	.460	35	.000
weekend free per day	.182	35	.005	.873	35	.001
home clubs on school days	.313	35	.000	.707	35	.000
home free on school days	.201	35	.001	.852	35	.000
total activity per school day	.081	35	.200*	.954	35	.150
total activity per weekend day	.161	35	.022	.898	35	.003
totalschoolperday	.139	35	.087	.951	35	.119
totalhomeperschoolday	.109	35	.200*	.928	35	.024
total free per school day	.146	35	.056	.880	35	.001
total free per weekend day	.182	35	.005	.873	35	.001

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

b. Gender = girl

Table 19: Tests for Homogeneity of Variance

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
school club per day	Based on Mean	3.419	1	51	.070
	Based on Median	1.574	1	51	.215
	Based on Median and with adjusted df	1.574	1	43.690	.216
	Based on trimmed mean	2.430	1	51	.125
school free per day	Based on Mean	1.857	1	51	.179
	Based on Median	1.042	1	51	.312
	Based on Median and with adjusted df	1.042	1	50.268	.312
	Based on trimmed mean	1.742	1	51	.193
weekday clubs per day	Based on Mean	2.279	1	51	.137
	Based on Median	.945	1	51	.336
	Based on Median and with adjusted df	.945	1	42.915	.336
	Based on trimmed mean	1.917	1	51	.172
weekday free per day	Based on Mean	.553	1	51	.461
	Based on Median	.207	1	51	.651
	Based on Median and with adjusted df	.207	1	44.130	.651
	Based on trimmed mean	.345	1	51	.560
weekend clubs per day	Based on Mean	.125	1	51	.725
	Based on Median	.036	1	51	.849
	Based on Median and with adjusted df	.036	1	50.494	.849
	Based on trimmed mean	.080	1	51	.779
weekend free per day	Based on Mean	2.945	1	51	.092
	Based on Median	2.754	1	51	.103
	Based on Median and with adjusted df	2.754	1	49.415	.103
	Based on trimmed mean	2.816	1	51	.099
home clubs on school days	Based on Mean	2.076	1	51	.156
	Based on Median	.228	1	51	.635
	Based on Median and with adjusted df	.228	1	44.816	.636
	Based on trimmed mean	1.559	1	51	.218
home free on school days	Based on Mean	.074	1	51	.787
	Based on Median	.001	1	51	.971
	Based on Median and with adjusted df	.001	1	44.970	.971
	Based on trimmed mean	.004	1	51	.951
total activity per school day	Based on Mean	.318	1	51	.576
	Based on Median	.296	1	51	.589
	Based on Median and with adjusted df	.296	1	50.741	.589
	Based on trimmed mean	.289	1	51	.593
total activity per weekend day	Based on Mean	.428	1	51	.516
	Based on Median	.600	1	51	.442
	Based on Median and with adjusted df	.600	1	50.062	.442
	Based on trimmed mean	.521	1	51	.474
totalschoolperday	Based on Mean	1.601	1	51	.211
	Based on Median	1.336	1	51	.253
	Based on Median and with adjusted df	1.336	1	50.179	.253
	Based on trimmed mean	1.618	1	51	.209
totalhomeperschoolday	Based on Mean	.152	1	51	.698
	Based on Median	.159	1	51	.691
	Based on Median and with adjusted df	.159	1	50.584	.691
	Based on trimmed mean	.120	1	51	.730
school free per day	Based on Mean	.553	1	51	.461
	Based on Median	.207	1	51	.651
	Based on Median and with adjusted df	.207	1	44.130	.651
	Based on trimmed mean	.345	1	51	.560
weekend free per day	Based on Mean	2.945	1	51	.092
	Based on Median	2.754	1	51	.103
	Based on Median and with adjusted df	2.754	1	49.415	.103
	Based on trimmed mean	2.816	1	51	.099

Table 20: Independent t tests for gender differences between categories

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
school club per day	Equal variances assumed	3.419	.070	-1.071	51	.289	-4.943	4.613	-14.204	4.319
	Equal variances not assumed			-1.231	48.459	.224	-4.943	4.016	-13.016	3.130
school free per day	Equal variances assumed	1.857	.179	2.990	51	.004	20.286	6.785	6.665	33.906
	Equal variances not assumed			3.164	40.165	.003	20.286	6.411	7.330	33.242
weekday clubs per day	Equal variances assumed	2.279	.137	-.957	51	.343	-8.457	8.836	-26.196	9.281
	Equal variances not assumed			-1.061	45.115	.294	-8.457	7.971	-24.511	7.597
weekday free per day	Equal variances assumed	.553	.461	1.772	51	.082	36.448	20.568	-4.844	77.739
	Equal variances not assumed			1.911	42.173	.063	36.448	19.077	-2.047	74.942
weekend clubs per day	Equal variances assumed	.125	.725	-.191	51	.849	-3.667	19.208	-42.228	34.895
	Equal variances not assumed			-.198	37.990	.844	-3.667	18.529	-41.177	33.843
weekend free per day	Equal variances assumed	2.945	.092	3.032	51	.004	83.024	27.383	28.050	137.998
	Equal variances not assumed			2.745	26.641	.011	83.024	30.247	20.923	145.125
home clubs on school days	Equal variances assumed	2.076	.156	-.459	51	.648	-3.514	7.649	-18.870	11.842
	Equal variances not assumed			-.503	43.912	.617	-3.514	6.980	-17.583	10.555
home free on school day	Equal variances assumed	.074	.787	1.046	51	.300	16.162	15.444	-14.843	47.167
	Equal variances not assumed			1.097	39.151	.279	16.162	14.734	-13.636	45.960
total activity per school day	Equal variances assumed	.318	.576	1.335	51	.188	27.990	20.965	-14.098	70.079
	Equal variances not assumed			1.381	37.773	.175	27.990	20.266	-13.045	69.026
total activity per weeken day	Equal variances assumed	.428	.516	2.674	51	.010	79.357	29.678	19.775	138.939
	Equal variances not assumed			2.594	31.713	.014	79.357	30.598	17.010	141.705
totalschoolperday	Equal variances assumed	1.601	.211	1.963	51	.055	15.343	7.815	-.346	31.032
	Equal variances not assumed			2.101	41.341	.042	15.343	7.304	.595	30.091
totalhomeperschoolday	Equal variances assumed	.152	.698	.758	51	.452	12.648	16.679	-20.837	46.132
	Equal variances not assumed			.779	37.121	.441	12.648	16.226	-20.227	45.522
school free per day	Equal variances assumed	.553	.461	1.772	51	.082	36.448	20.568	-4.844	77.739
	Equal variances not assumed			1.911	42.173	.063	36.448	19.077	-2.047	74.942
weekend free per day	Equal variances assumed	2.945	.092	3.032	51	.004	83.024	27.383	28.050	137.998
	Equal variances not assumed			2.745	26.641	.011	83.024	30.247	20.923	145.125

Paired t tests for category differences within gender

Table 21: Boys

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	school club per day - school free per day	-35.000	23.934	5.641	-46.902	-23.098	-6.204	17	.000
Pair 2	weekday clubs per day - weekday free per day	-90.333	61.790	14.564	-121.061	-59.606	-6.202	17	.000
Pair 3	weekend clubs per day - weekend free per day	-145.833	146.772	34.594	-218.821	-72.846	-4.216	17	.001
Pair 4	home clubs on school days - home free on school days	-55.333	51.018	12.025	-80.704	-29.963	-4.602	17	.000
Pair 5	totalschoolperday - totalhomeperschoolday	-28.333	49.426	11.650	-52.912	-3.754	-2.432	17	.026
Pair 6	total free per school day - total free per weekend day	-52.833	71.743	16.910	-88.510	-17.156	-3.124	17	.006
Pair 7	total activity per school day - total activity per weekend day	-50.167	79.305	18.692	-89.604	-10.729	-2.684	17	.016

a. Gender = boy

Table 22: Girls

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	school club per day - school free per day	-9.771	32.018	5.412	-20.770	1.227	-1.806	34	.080
Pair 2	weekday clubs per day - weekday free per day	-45.429	90.133	15.235	-76.390	-14.467	-2.982	34	.005
Pair 3	weekend clubs per day - weekend free per day	-59.143	115.844	19.581	-98.937	-19.349	-3.020	34	.005
Pair 4	home clubs on school days - home free on school days	-35.657	65.806	11.123	-58.262	-13.052	-3.206	34	.003
Pair 5	totalschoolperday - totalhomeperschoolday	-31.029	55.135	9.319	-49.968	-12.089	-3.329	34	.002
Pair 6	total free per school day - total free per weekend day	-6.257	78.438	13.258	-33.201	20.687	-.472	34	.640
Pair 7	total activity per school day - total activity per weekend day	1.200	81.502	13.776	-26.797	29.197	.087	34	.931

a. Gender = girl

Cross tabulation for numbers and proportions achieving recommended levels following reanalysis with 3 time blocks as cut off point.

Table 23: Monday

Crosstab

			mon achieved 90		
			not achieved 90	achieved 90	Total
Gender	boy	Count	6	12	18
		% within Gender	33.3%	66.7%	100.0%
		% within mon achieved 90	26.1%	40.0%	34.0%
		% of Total	11.3%	22.6%	34.0%
	girl	Count	17	18	35
		% within Gender	48.6%	51.4%	100.0%
		% within mon achieved 90	73.9%	60.0%	66.0%
		% of Total	32.1%	34.0%	66.0%
Total		Count	23	30	53
		% within Gender	43.4%	56.6%	100.0%
		% within mon achieved 90	100.0%	100.0%	100.0%
		% of Total	43.4%	56.6%	100.0%

Table 24: Tuesday

Crosstab

			tues achieved 90		
			not achieved 90	achieved 90	Total
Gender	boy	Count	4	14	18
		% within Gender	22.2%	77.8%	100.0%
		% within tues achieved 90	25.0%	37.8%	34.0%
		% of Total	7.5%	26.4%	34.0%
	girl	Count	12	23	35
		% within Gender	34.3%	65.7%	100.0%
		% within tues achieved 90	75.0%	62.2%	66.0%
		% of Total	22.6%	43.4%	66.0%
Total		Count	16	37	53
		% within Gender	30.2%	69.8%	100.0%
		% within tues achieved 90	100.0%	100.0%	100.0%
		% of Total	30.2%	69.8%	100.0%

Table 25: Wednesday

Crosstab

			wed achieved 90		
			not achieved 90	achieved 90	Total
Gender	boy	Count	2	16	18
		% within Gender	11.1%	88.9%	100.0%
		% within wed achieved 90	13.3%	42.1%	34.0%
		% of Total	3.8%	30.2%	34.0%
	girl	Count	13	22	35
		% within Gender	37.1%	62.9%	100.0%
		% within wed achieved 90	86.7%	57.9%	66.0%
		% of Total	24.5%	41.5%	66.0%
Total		Count	15	38	53
		% within Gender	28.3%	71.7%	100.0%
		% within wed achieved 90	100.0%	100.0%	100.0%
		% of Total	28.3%	71.7%	100.0%

Table 26: Thursday

Crosstab

			thurs achieved 90		
			not achieved 90	achieved 90	Total
Gender	boy	Count	3	15	18
		% within Gender	16.7%	83.3%	100.0%
		% within thurs achieved 90	20.0%	39.5%	34.0%
		% of Total	5.7%	28.3%	34.0%
	girl	Count	12	23	35
		% within Gender	34.3%	65.7%	100.0%
		% within thurs achieved 90	80.0%	60.5%	66.0%
		% of Total	22.6%	43.4%	66.0%
Total		Count	15	38	53
		% within Gender	28.3%	71.7%	100.0%
		% within thurs achieved 90	100.0%	100.0%	100.0%
		% of Total	28.3%	71.7%	100.0%

Table 27: Friday

Crosstab

			fri achieved 90		
			not achieved 90	achieved 90	Total
Gender	boy	Count	4	14	18
		% within Gender	22.2%	77.8%	100.0%
		% within fri achieved 90	26.7%	36.8%	34.0%
		% of Total	7.5%	26.4%	34.0%
	girl	Count	11	24	35
		% within Gender	31.4%	68.6%	100.0%
		% within fri achieved 90	73.3%	63.2%	66.0%
		% of Total	20.8%	45.3%	66.0%
Total		Count	15	38	53
		% within Gender	28.3%	71.7%	100.0%
		% within fri achieved 90	100.0%	100.0%	100.0%
		% of Total	28.3%	71.7%	100.0%

Table 28: Saturday

Crosstab

			sat achieved 90		
			not achieved 90	achieved 90	Total
Gender	boy	Count	3	15	18
		% within Gender	16.7%	83.3%	100.0%
		% within sat achieved 90	16.7%	42.9%	34.0%
		% of Total	5.7%	28.3%	34.0%
	girl	Count	15	20	35
		% within Gender	42.9%	57.1%	100.0%
		% within sat achieved 90	83.3%	57.1%	66.0%
		% of Total	28.3%	37.7%	66.0%
Total		Count	18	35	53
		% within Gender	34.0%	66.0%	100.0%
		% within sat achieved 90	100.0%	100.0%	100.0%
		% of Total	34.0%	66.0%	100.0%

Table 29: Sunday

Crosstab

			sun achieved 90		
			not achieved 90	achieved 90	Total
Gender	boy	Count	5	13	18
		% within Gender	27.8%	72.2%	100.0%
		% within sun achieved 90	22.7%	41.9%	34.0%
		% of Total	9.4%	24.5%	34.0%
	girl	Count	17	18	35
		% within Gender	48.6%	51.4%	100.0%
		% within sun achieved 90	77.3%	58.1%	66.0%
		% of Total	32.1%	34.0%	66.0%
Total		Count	22	31	53
		% within Gender	41.5%	58.5%	100.0%
		% within sun achieved 90	100.0%	100.0%	100.0%
		% of Total	41.5%	58.5%	100.0%

Chi square tests for gender differences following reanalysis with 3 time blocks as cut off point.

Table 30: Monday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.124[b]	1	.289		
Continuity Correction[a]	.589	1	.443		
Likelihood Ratio	1.140	1	.286		
Fisher's Exact Test				.384	.222
Linear-by-Linear Association	1.102	1	.294		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7. 81.

Table 31: Tuesday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.821[b]	1	.365		
Continuity Correction[a]	.348	1	.555		
Likelihood Ratio	.847	1	.357		
Fisher's Exact Test				.530	.281
Linear-by-Linear Association	.805	1	.370		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5. 43.

Table 32: Wednesday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.970[b]	1	.046		
Continuity Correction[a]	2.790	1	.095		
Likelihood Ratio	4.415	1	.036		
Fisher's Exact Test				.059	.043
Linear-by-Linear Association	3.895	1	.048		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5. 09.

Table 33: Thursday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1.818[b]	1	.177		
Continuity Correction[a]	1.054	1	.305		
Likelihood Ratio	1.929	1	.165		
Fisher's Exact Test				.215	.152
Linear-by-Linear Association	1.784	1	.182		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5. 09.

Table 34: Friday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.496[b]	1	.481		
Continuity Correction[a]	.146	1	.702		
Likelihood Ratio	.509	1	.475		
Fisher's Exact Test				.539	.357
Linear-by-Linear Association	.487	1	.485		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 5. 09.

Table 35: Saturday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	3.635[b]	1	.057		
Continuity Correction[a]	2.561	1	.109		
Likelihood Ratio	3.899	1	.048		
Fisher's Exact Test				.072	.052
Linear-by-Linear Association	3.567	1	.059		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 6. 11.

Table 36: Sunday

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.117[b]	1	.146		
Continuity Correction[a]	1.347	1	.246		
Likelihood Ratio	2.176	1	.140		
Fisher's Exact Test				.239	.122
Linear-by-Linear Association	2.077	1	.150		
N of Valid Cases	53				

a. Computed only for a 2x2 table

b. 0 cells (.0%) have expected count less than 5. The minimum expected count is 7. 47.

Reanalysis following removal of outliers

Table 37: Tests for normality for categories per school day and weekend day

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
school club per day	.277	31	.000	.772	31	.000
school free per day	.140	31	.126	.914	31	.016
weekday clubs per day	.232	31	.000	.849	31	.000
weekday free per day	.119	31	.200*	.919	31	.023
weekend clubs per day	.467	31	.000	.481	31	.000
weekend free per day	.131	31	.191	.909	31	.012
home clubs on school days	.346	31	.000	.591	31	.000
home free on school days	.178	31	.014	.850	31	.001
total activity per school day	.126	31	.200*	.956	31	.228
total activity per weekend day	.122	31	.200*	.938	31	.073
totalschoolperday	.159	31	.045	.943	31	.102
totalhomeperschoolday	.135	31	.159	.924	31	.030

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

Tests for normality for categories per school day and weekend day by gender

Table 38: Boys

Tests of Normality[b]

	Gender	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
school club per day	boy	.235	9	.164	.780	9	.012
school free per day	boy	.196	9	.200*	.959	9	.786
weekday clubs per day	boy	.233	9	.175	.836	9	.052
weekday free per day	boy	.228	9	.197	.921	9	.404
weekend clubs per day	boy	.471	9	.000	.536	9	.000
weekend free per day	boy	.119	9	.200*	.963	9	.827
home clubs on school	boy	.319	9	.009	.656	9	.000
home free on school days	boy	.238	9	.150	.883	9	.170
total activity per school	boy	.248	9	.116	.871	9	.125
total activity per weekend	boy	.153	9	.200*	.963	9	.829
totalschoolperday	boy	.193	9	.200*	.944	9	.628
totalhomeperschoolday	boy	.152	9	.200*	.952	9	.712

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

b. Gender = boy

Table 39: Girls

Tests of Normality[b]

	Gender	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
school club per day	girl	.289	22	.000	.768	22	.000
school free per day	girl	.199	22	.023	.838	22	.002
weekday clubs per day	girl	.228	22	.004	.847	22	.003
weekday free per day	girl	.155	22	.183	.859	22	.005
weekend clubs per day	girl	.476	22	.000	.475	22	.000
weekend free per day	girl	.176	22	.074	.832	22	.002
home clubs on school	girl	.372	22	.000	.561	22	.000
home free on school days	girl	.185	22	.048	.815	22	.001
total activity per school	girl	.098	22	.200*	.964	22	.583
total activity per weekend	girl	.136	22	.200*	.882	22	.013
totalschoolperday	girl	.189	22	.039	.905	22	.037
totalhomeperschoolday	girl	.158	22	.162	.911	22	.049

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction

b. Gender = girl

Table 40: Paired t tests for significant differences between categories

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	school club per day - school free per day	-12.968	31.142	5.593	-24.391	-1.545	-2.318	30	.027
Pair 2	weekday clubs per day - weekday free per day	-38.129	62.461	11.218	-61.040	-15.218	-3.399	30	.002
Pair 3	weekend clubs per day - weekend free per day	-58.065	68.163	12.242	-83.067	-33.062	-4.743	30	.000
Pair 4	home clubs on school days - home free on school days	-25.161	45.310	8.138	-41.781	-8.541	-3.092	30	.004
Pair 5	total activity per school day - total activity per weekend day	11.226	52.621	9.451	-8.076	30.527	1.188	30	.244
Pair 6	totalschoolperday - totalhomeperschoolday	-7.548	38.104	6.844	-21.525	6.428	-1.103	30	.279

Table 41: Tests for Homogeneity of variance

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
school club per day	Based on Mean	.972	1	29	.332
	Based on Median	.457	1	29	.505
	Based on Median and with adjusted df	.457	1	25.804	.505
	Based on trimmed mean	.550	1	29	.464
school free per day	Based on Mean	.025	1	29	.875
	Based on Median	.084	1	29	.773
	Based on Median and with adjusted df	.084	1	27.667	.774
	Based on trimmed mean	.026	1	29	.873
weekday clubs per day	Based on Mean	.082	1	29	.777
	Based on Median	.060	1	29	.808
	Based on Median and with adjusted df	.060	1	28.772	.808
	Based on trimmed mean	.103	1	29	.751
weekday free per day	Based on Mean	2.288	1	29	.141
	Based on Median	1.407	1	29	.245
	Based on Median and with adjusted df	1.407	1	27.010	.246
	Based on trimmed mean	2.110	1	29	.157
weekend clubs per day	Based on Mean	1.001	1	29	.325
	Based on Median	.161	1	29	.692
	Based on Median and with adjusted df	.161	1	24.948	.692
	Based on trimmed mean	.387	1	29	.539
weekend free per day	Based on Mean	.072	1	29	.791
	Based on Median	.032	1	29	.859
	Based on Median and with adjusted df	.032	1	27.871	.859
	Based on trimmed mean	.033	1	29	.858
home clubs on school days	Based on Mean	.455	1	29	.505
	Based on Median	.322	1	29	.575
	Based on Median and with adjusted df	.322	1	27.078	.575
	Based on trimmed mean	.290	1	29	.594
home free on school days	Based on Mean	2.817	1	29	.104
	Based on Median	2.209	1	29	.148
	Based on Median and with adjusted df	2.209	1	28.382	.148
	Based on trimmed mean	2.593	1	29	.118
total activity per school day	Based on Mean	.020	1	29	.889
	Based on Median	.223	1	29	.640
	Based on Median and with adjusted df	.223	1	27.451	.640
	Based on trimmed mean	.025	1	29	.875
total activity per weekend day	Based on Mean	.213	1	29	.648
	Based on Median	.221	1	29	.642
	Based on Median and with adjusted df	.221	1	27.892	.642
	Based on trimmed mean	.207	1	29	.652
totalschoolperday	Based on Mean	.330	1	29	.570
	Based on Median	.240	1	29	.628
	Based on Median and with adjusted df	.240	1	28.980	.628
	Based on trimmed mean	.329	1	29	.571
totalhomeperschoolday	Based on Mean	.290	1	29	.595
	Based on Median	.209	1	29	.651
	Based on Median and with adjusted df	.209	1	28.765	.651
	Based on trimmed mean	.257	1	29	.616

Table 42: Independent t tests for gender differences between categories

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
school club per day	Equal variances assumed	.972	.332	-.718	29	.478	-5.000	6.964	-19.242	9.242
	Equal variances not assumed			-.860	23.044	.399	-5.000	5.813	-17.024	7.024
school free per day	Equal variances assumed	.025	.875	4.013	29	.000	29.333	7.309	14.384	44.283
	Equal variances not assumed			3.996	14.801	.001	29.333	7.340	13.671	44.996
weekday clubs per day	Equal variances assumed	.082	.777	-.014	29	.989	-.152	10.758	-22.154	21.851
	Equal variances not assumed			-.014	14.672	.989	-.152	10.848	-23.319	23.016
weekday free per day	Equal variances assumed	2.288	.141	1.628	29	.114	31.606	19.410	-8.093	71.305
	Equal variances not assumed			1.889	21.258	.073	31.606	16.734	-3.168	66.380
weekend clubs per day	Equal variances assumed	1.001	.325	-.401	29	.692	-3.561	8.885	-21.733	14.612
	Equal variances not assumed			-.514	26.781	.612	-3.561	6.933	-17.792	10.670
weekend free per day	Equal variances assumed	.072	.791	1.815	29	.080	41.439	22.828	-5.249	88.128
	Equal variances not assumed			1.905	16.616	.074	41.439	21.756	-4.542	87.421
home free on school days	Equal variances assumed	2.817	.104	.160	29	.874	2.273	14.237	-26.846	31.392
	Equal variances not assumed			.190	22.553	.851	2.273	11.989	-22.556	27.101
total activity per school day	Equal variances assumed	.020	.889	1.597	29	.121	31.455	19.695	-8.827	71.736
	Equal variances not assumed			1.622	15.450	.125	31.455	19.387	-9.763	72.672
total activity per weekend day	Equal variances assumed	.213	.648	1.665	29	.107	37.879	22.748	-8.645	84.403
	Equal variances not assumed			1.770	17.136	.094	37.879	21.396	-7.235	82.992
total activity per day	Equal variances assumed	.035	.853	1.878	29	.071	34.667	18.464	-3.096	72.429
	Equal variances not assumed			1.971	16.632	.066	34.667	17.589	-2.506	71.840
totalschoolperday	Equal variances assumed	.330	.570	2.603	29	.014	24.333	9.349	5.212	43.455
	Equal variances not assumed			2.653	15.569	.018	24.333	9.171	4.849	43.818
totalhomeperschoolday	Equal variances assumed	.290	.595	.481	29	.634	7.121	14.799	-23.147	37.389
	Equal variances not assumed			.498	16.133	.625	7.121	14.287	-23.145	37.388

Paired t tests for category differences within gender

Table 43: Boys

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	school club per day - school free per day	-37.333	21.794	7.265	-54.086	-20.581	-5.139	8	.001
Pair 2	weekday clubs per day - weekday free per day	-60.667	43.829	14.610	-94.357	-26.977	-4.152	8	.003
Pair 3	weekend clubs per day - weekend free per day	-90.000	57.609	19.203	-134.282	-45.718	-4.687	8	.002
Pair 4	home clubs on school days - home free on school days	-23.333	37.762	12.587	-52.360	5.693	-1.854	8	.101
Pair 5	total activity per school day - total activity per weekend day	6.667	51.674	17.225	-33.054	46.387	.387	8	.709
Pair 6	totalschoolperday - totalhomeperschoolday	4.667	34.307	11.436	-21.704	31.038	.408	8	.694

a. Gender = boy

Table 44: Girls

Paired Samples Test[a]

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	school club per day - school free per day	-3.000	29.086	6.201	-15.896	9.896	-.484	21	.634
Pair 2	weekday clubs per day - weekday free per day	-28.909	67.341	14.357	-58.766	.948	-2.014	21	.057
Pair 3	weekend clubs per day - weekend free per day	-45.000	68.972	14.705	-75.580	-14.420	-3.060	21	.006
Pair 4	home clubs on school days - home free on school days	-25.909	48.863	10.418	-47.574	-4.244	-2.487	21	.021
Pair 5	total activity per school day - total activity per weekend day	13.091	54.092	11.532	-10.892	37.074	1.135	21	.269
Pair 6	totalschoolperday - totalhomeperschoolday	-12.545	39.188	8.355	-29.920	4.829	-1.502	21	.148

a. Gender = girl